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THE AMERICAN INVADER IN ROME.

A brief account of the new San Paolo steam-turbine plant in Rome gives one an extraordinarily vivid idea of the way in which American enterprise has pushed ahead even in the oldest and most conservative parts of the Continent. The American engineer casually visiting this power plant on the banks of the Tiber would feel himself singularly at home. The turbines, the electric apparatus, the boilers, the transformers and even the general layout of the plant would bring back the sights and sounds of his native American city. In fact, the San Paolo plant is built on exactly the lines of current practice in America, representing the latest ideas in steam generating and utilizing equipments. Of the three turbo-generators two are of the ordinary vertical Curtis type and the third one is of the latest horizontal pattern of the same general type. The boiler house in its arrangement and equipment might be in Buffalo, New Orleans or Seattle just as well as in Rome, except for slight differences of machine design and the name plates.

The Italian electrical engineers have been wonderfully clever in their utilization of the hydraulic resources of Italy, and Rome has long been supplied with energy from hydroelectric plants; but in Italy as here the needs for electric service have outrun the capacity of conveniently available streams. Hence the erection of the present plant. The adoption of a steam auxiliary modeled closely after recent American practice is, after all, perhaps less the result of the invasion of American ideas than it is a repayment of the debt which America owes to the Continent. We have profited greatly by the research work and the engineering prowess of our transatlantic colleagues. It is only fitting that we should pay them back in their own good coin by thus providing an example which represents a standard of not only American but international value.

GROUND-RETURN DISTRIBUTION SYSTEMS.

A quarter of a century's progress in the electrical arts, which has been so potent a factor in the development of our great cities, has by no means been without its influence on country life. Long ago the telephone destroyed the farmer's isolation and by its subtle annihilation of distances drove back the narrow horizon of his existence and brought the pulse of civilization to his door. The transformation continued with new vigor as the interurban electric railway added cheap and efficient transportation to the luxury of quick communication. It then remained for the central station to weave its network across the fields from town to country and supply the farmer's last need, an abundance of cheap energy for lighting, heating and labor-saving motor service. This last development the

central stations of the country have been engaged in but a short time, comparatively, and numerous engineering problems of a semi-economic nature await solution.

The distribution problem presents several difficulties, notably in the direction of reducing the investment charges and eliminating the likelihood of interruptions to service. A policy of co-operation between the supply company and its rural customers, leading to concessions in right-of-way privileges and assistance in the matter of supplying poles and furnishing free labor to reduce construction costs, has been found extremely helpful. But the cost of line conductors is frequently a serious matter, especially in the case of pioneer development, when the expected returns on the investment barely, if at all, justify the venture. Hence the expedient of adopting a ground return for the primary distribution and cutting in half the conductor investment carries a strong argument. Two recent instances of this practice have been mentioned in these columns, one on page 259 of the issue of Aug. 3 and another on page 1187 of the issue of June 1. No danger of electrolysis arises because alternating-current supply is invariably employed, usually at 60 cycles. But the possibility of creating inductive disturbances of serious magnitude in parallel telephone and telegraph lines in the neighborhood is a live issue.

As is well known, the secondary induced emf in a parallel circuit, due to electromagnetic induction, increases rapidly as the phase wires of the primary or inducing circuit have their separation increased, and becomes a maximum when one of the conductors is removed entirely and an earth return substituted in its place. Of course, the induced emf due to such induction, with a given spacing, varies with the primary current, or load, but the electrostatic induction is present continuously, with constant magnitude, so long as the primary is energized. Examples of severely inductive circuits may be cited in constant-current series lines employed for street lighting and laid out on the open-loop plan, and again in the trolley circuits of single-phase alternating-current traction systems, particularly the latter type. The defects in constant-current series circuits of the open-loop type were recognized by the overhead line construction committee of the N. E. L. A., and the closed-loop type is now recommended by that body as the best practice. When the interests of a central-station company and a telephone or telegraph company thus become involved, the third or public interest requires that neither of the former interests should place an undue burden on the other, for the public is equally concerned in efficient central-station service and efficient communication—a broad principle which in substance already has been laid down in electrolysis cases, as affecting electric railway and water or gas companies. The burden imposed on a telephone company operating its lines parallel to a ground-return distribution system will at once be reduced to a bearable degree by installing the missing phase wire and placing it in service. The expedient of a ground return for the sake of economy, or any other reason except a serious emergency, ought therefore to be adopted with the utmost caution, if at all, and the quest for economy should turn toward a cheaper type of conductor or higher line pressures.

WHITE LIGHT FROM THE MERCURY ARC.

In another column Dr. Herbert E. Ives gives the results of a practical investigation of the results obtainable from Dr. Peter Cooper Hewitt's beautifully ingenious fluorescent light transformer. It is well known that by the use of a certain amount of light from incandescent lamps in connection with the mercury arc a light at least approximately white is obtainable. The improved color is reached through the addition of the superabundance of red rays conspicuous in the spectra of incandescent lamps of the usual kinds. In terms of the readings obtained with the colorimeter used by Dr. Ives the incandescent lamp gives generally speaking a little less than twice as much red in the spectrum as is needed to provide true white. On the other hand, it gives only a little over one-fifth the amount of blue required for the normal white of the colorimeter. Now, the mercury arc provides an excess of blue and almost no red, so that the mixture of its light with that of incandescent lamps gives a fairly well-balanced composition. Dr. Ives, who did much work on such mixtures, has recently been studying the results obtained from the light transfer. The mixture process is a beautifully additive one, but the light transformer, in virtue of producing its red component at the expense chiefly of the green mercury line, subtracts part of the original light in order to add the component of long wave-length.

The fluorescent reflector when of sufficient area adds enough energy in the red to the final light to bring the resultant red component fully up to normal for a white light. Incidentally it lowers the proportion of green very materially and that of blue somewhat, bringing the former below normal and the latter not quite down to normal. The total result with the fluorescent reflector is to produce a light which in its colorimetric composition lies reasonably near to white. There is, however, the curious distinction that, owing to the deficiency in green rays when the red is brought to the normal by fluorescence, the resultant tint is a slightly pinkish white, which, as Dr. Ives remarks, "is in the direction in which cloudy and smoky city daylight most consistently varies from the average daylight of these measurements." In other words, the addition of fluorescent light, accompanied as it is by the diminution of the green, does not result in a theoretically pure white, but at its best in white faintly tinged with pink. Such a light, as Dr. Ives shows, is not perfect for color matching, although the general effect is excellent.

It would be an interesting corollary to Dr. Ives' research to follow up the investigation using as the starting point not the ordinary glass-tube mercury-arc lamp but the quartz-tube mercury-arc lamp. The light from the latter is much more nearly white than is that from the former, possessing not enough red, but a very material amount, together with a large amount of green and blue. Hence when used with the light transformer the proportion of green rays should be far more nearly normal than in the case of the ordinary mercury tube, since less has to be subtracted from the green rays to add the necessary amount of red. When using a suitable area of transformer the result ought to be a light which in colorimetric composition approximates very closely average daylight, much more

closely than do any of the illuminants mentioned by Dr. Ives. It does not follow, of course, that the light from the quartz-tube mercury-arc lamp with fluorescent reflector would be entirely satisfactory for color matching, but the source would be peculiarly interesting to investigate as a step toward obtaining white light from a source giving light having discontinuous spectra.

INCREASING THE RANGE OF SHUNT-VOLTAGE REGULATION IN DIRECT-CURRENT GENERATORS.

A matter of considerable practical importance in the operation of direct-current shunt generators is that relating to the range of voltage regulation that can be obtained by variation of the shunt-field current. As is well known, a shunt generator driven at rated speed will give its maximum no-load voltage when its shunt-field rheostat is completely short-circuited. Commencing with this maximum voltage, the voltage can be reduced by successive steps as resistance is cut into the field rheostat. When, however, the voltage has been reduced to such a point that the saturation curve becomes a straight line, further steps of increase in shunt-field resistance, if there is room left for them in the rheostat, may be useless, since the voltage becomes unstable and may collapse to zero.

Shunt-field generator operation can be represented graphically by plotting the saturation curve, or external characteristic curve, of the machine with terminal volts as ordinates and shunt-field currents as abscissas. On this diagram is drawn through the origin an ascending straight line such that it represents at any ordinate the voltage required to send the abscissa field current through the total resistance of the shunt-field circuit, including that of the rheostat. Where this straight line intersects the characteristic curve is the stable point of automatic voltage operation at the speed considered. If, now, more resistance is inserted in the field rheostat, the straight line is made steeper and must intersect the characteristic at a point of lower voltage. The first consideration for effective automatic regulation at the lower range of voltage is that the saturation curve shall bend over and not be straight in the region considered.

Mr. P. Amsler recently proposed that the curvature of the lower range of the saturation curve be brought about by so constructing the iron for a very short distance in the polar faces that this portion of the magnetic circuit soon reaches saturation and yet the total extra reluctance at high fluxes is not excessive. That is to say, stability of automatic regulation in the lower range of voltages is effected at the expense of some extra reluctance and excitation in the upper range. In cases where this extra excitation is not detrimental the added range of regulation is pure gain. The relative advantage of economy of excitation at the high voltages and stability of automatic regulation at the low voltages is for the designer to determine, but the method outlined in the article has its distinct merits. We believe, however, that a similar pole-face construction of projecting laminas has been used in the past for the purpose of improving commutation.

ENERGY TRANSMISSION-LINE PHENOMENA.

Of the many methods for studying the performance of long-distance energy transmission lines the best thus far developed from a theoretical point of view is the so-called hyperbolic treatment, while from an experimental viewpoint the most satisfactory method is one involving the use of an artificial line having constants equivalent to those of the actual line represented. Our present issue contains two remarkably convincing articles dealing with both phases of this general subject, one by Dr. A. E. Kennelly, who has done excellent pioneer work in advocating the application of hyperbolic functions to electrical engineering problems, and the other by Mr. John F. H. Douglas, who describes an interesting series of tests on long artificial transmission lines which confirm the theories and deductions of Dr. Kennelly. Both of these articles may well be considered as valuable elaborations and verifications of the combined theoretical and experimental investigation described by Messrs. A. E. Kennelly and H. Tabossi in our issue dated Feb. 17, 1912.

We are so accustomed to the use of Ohm's law, as applied most conveniently to direct-current circuits, and we are so prone to carry Ohm's law reasoning to the behavior of alternating-current circuits of every description that marked discrepancies between the behavior of alternating-current and direct-current circuits surprise us. The behavior of alternating-current lines containing distributed inductance and capacity is always capable of bringing surprises to the observer whose horizon has been bounded by the great law of Ohm. It is in connection with the study of such phenomena that the hyperbolic treatment becomes most markedly advantageous. A striking demonstration of this fact is given in the article by Dr. Kennelly in this issue. In the article in our issue for Feb. 17, 1912, the experimental investigation of transmission-line phenomena was carried to about one-quarter wave-length; that is, to a distance equal to one-quarter the length of the wave that develops on it in operation. An increasing voltage was found from the beginning to the end of the line, attributable, in simple terms, to the passing of the leading charging current through the inductance of the line. The investigation by Mr. Douglas recorded in this issue shows that when the line is so "loaded" as to increase its length to a half-wave all of the terminal troubles disappear and the regulation of pressure, instead of being distressingly bad, is better than if the line were operated by direct current. Moreover, the regulation of voltage is much better for inductive than non-inductive load.

Aside from the question as to practical means for imitating half-wave behavior on actual lines, the conception of making a line supply its own charging current by half-wave action, without making the generator deliver it, is very fascinating. It begins to be evident that, whatever particular means may be best to adopt in practice, the electrical engineer will be able to transmit energy to distances much greater than at present whenever the economic demand shall make it necessary to do so. Experimental researches like those described in the article are of great value in clearing up the hazy conceptions which still exist concerning these rather complex phenomena.

CO-OPERATION BETWEEN BRITISH AND AMERICAN ILLUMINATING ENGINEERING SOCIETIES.

At a special meeting of the New York Section of the Illuminating Engineering Society held on Aug. 1 an address entitled "A Résumé of Progress in Illuminating Engineering in Europe" was delivered by Mr. Leon Gaster, honorary secretary of the (British) Illuminating Engineering Society. Mr. Gaster outlined the work accomplished by the society during the past few years. It has paid particular attention to the subjects of glare, the measurement and definition of illumination, the illumination of schools, street lighting and illuminating engineering education. The work of the society has been recognized in the official publications of the government, and the importance of illumination in the prevention of accidents is being appreciated throughout all British industries. Mr. Gaster claimed that the membership of the (British) Illuminating Engineering Society is international, and that the society should be recognized as international. By reason of the location of its headquarters in London, the British society finds itself in an excellent position to act as the connecting link between the Illuminating Engineering Society in the United States and European technical societies with which it may have dealings. As the official representative of the (British) Illuminating Engineering Society, Mr. Gaster asked for the co-operation of the Illuminating Engineering Society in the United States.

The subject brought forward by Mr. Gaster was discussed by Mr. Albert J. Marshall, Dr. Clayton H. Sharp, Mr. L. B. Marks, Mr. Norman Macbeth, Dr. Herbert E. Ives and Mr. D. MacFarlan Moore. Dr. Sharp explained that when the (British) Illuminating Engineering Society was organized the existing Illuminating Engineering Society sent a cablegram expressing its desire to co-operate with the new society and it has continued to maintain the same attitude. The Illuminating Engineering Society in this country encounters difficulty in obtaining government co-operation in view of the fact that each state has its own laws and set of officers, while the whole of England is controlled by one set of laws and officers. It was pointed out in the discussion that while much progress in the theory of illumination has been made in England, yet the actual examples of modern lighting installations are few in number. In America, on the other hand, the improvement in illumination practice has been quite general, especially in street lighting.

COMPARISON OF CHICAGO ELECTROLYSIS ORDINANCE AND BRITISH BOARD OF TRADE REGULATIONS.

The electrolysis ordinance recently passed by the City Council of Chicago, as already noted in these columns, is of special interest because it contains rather severe requirements, as judged from precedents already created in American cities, and compares rather favorably with the British Board of Trade regulations. Section 1 of the Chicago ordinance is as follows:

"All uninsulated electrical return circuits must be of such current-carrying capacity and so arranged that the difference of potential between any two points on the return will not exceed the limit of 12 volts, and between any two points on the return 1000 ft. apart within 1 mile radius of the City Hall will not exceed the limit of 1 volt, and between any two points on the return 700 ft. apart outside of this 1-mile-radius limit will not exceed the limit of 1 volt. In addition thereto a proper return-conductor system must be so installed and maintained as to protect all metallic work from electrolysis damage.

"The return-current amperage on pipes and cable sheaths must not be greater than 0.5 amp per pound-foot for calked cast-iron pipe, 8 amp per pound-foot for screwed wrought-iron pipe, and 16 amp per pound-foot for standard lead or lead-alloy sheaths of cables."

In order to permit ready comparison, the corresponding features of the Board of Trade regulations are given below:

"Section 5. When any part of a return is uninsulated it shall be connected with the negative terminal of the generator, and in such case the negative terminal of the generator shall also be directly connected, through the current-indicator hereinafter mentioned, to two separate earth connections, which shall be placed not less than 20 yd. apart.

"Section 6. (1) That the current passing from the earth connections through the indicator to the generator shall not at any time exceed 2 amp per mile of single tramway line, or 5 per cent of the total current output of the station.

"(2) That if at any time and at any place a test be made by connecting a galvanometer or other current indicator to the uninsulated return and to any pipe in the vicinity, it shall always be possible to reverse the direction of any current indicated by interposing a battery of three Leclanché cells connected in series, if the direction of the current is from the return to the pipe, or by interposing one Leclanché cell, if the direction of the current is from the pipe to the return.

"In order to provide a continuous indication that the condition (1) is complied with, the company shall place in a conspicuous position a suitable, properly connected and correctly marked current indicator, and shall keep it connected during the whole time that the line is charged.

"Section 7. When the return is partly or entirely uninsulated, a continuous record shall be kept by the company of the difference of potential during the working of the tramway between the points of the uninsulated return furthest from and nearest to the generating station. If at any time such difference of potential exceeds the limit of 7 volts, the company shall take immediate steps to reduce it below that limit."

The maintenance features provided for in the Chicago ordinance, and the penalties for violation, are contained in Sections 2 to 5, next presented:

"Section 2. All persons, firms or corporations operating railways must equip their uninsulated return-current systems in the following manner:

"First—With insulated pilot-wire circuits and voltmeters so that accurate chart records will be obtained daily showing the difference of potential between the negative busbars in each station and at least four extreme limits on the return circuit in its corresponding feeding district.

"Second—With recording ammeters, insulated cables and automatic reverse-load and overload circuit-breakers which will record and limit the maximum amperes drained from all the metallic work (except the regular return feeders) to less than 10 per cent of the total output of the station. The said chart records must be so kept as to be always accessible to city officials.

"Section 3. Any person, firm or corporation failing to comply with the provisions of this ordinance after nine months from the date of its passage shall be fined not less than $50 nor more than $200 for each offense, and each day's operation of such equipment contrary to said provisions shall constitute and be regarded as a separate and distinct offense.

"Section 4. The last eight lines of paragraph 12 of Section 862 of the Chicago Code of 1911, said eight lines appearing on page 303 of the official edition of said Code, are hereby repealed.

"Section 5. This ordinance shall take effect and be in force from and after its passage and due publication."

As noted on page 138 of our issue of July 20, this ordinance was passed by the Chicago Council on July 16.

ELECTRICAL PROGRESS IN THE ARGENTINE REPUBLIC.

The Argentine Republic imports from the United States and Europe all the material required for the very varied and important electrical undertakings established or proposed, as there is no native industry for the manufacture of electrical materials. Remarkable progress has been made during recent years in both electric lighting and traction.

The use of electricity on a large scale in the Argentine Republic was initiated by Great Britain, but America and Germany are now formidable competitors. Thus in Buenos Aires the large tramway system was installed by means of English capital, but the supply of electrical energy is provided by the German Transatlantic Electric Company, which also provides energy for lighting. The importance of the electrical tramway system may be inferred from the fact that over 23,000,000 car-miles per annum are run, and large additions to the generating station were made within the last two years.

Recently a hydroelectric plant and a transmission line were installed at Cordoba, a prosperous and rapidly growing center. Energy is obtained from a fall in the River Primevo. The transmission line is operated at 10,000 volts. The present load connections include over 85,000 8-cp lamps, in addition to street lamps. Energy is also supplied to local industries. The district has 25 miles of electrical tramways.

Rosario, with its boulevards and luxurious suburbs, possesses more than 40 miles of underground distribution cables. The more central thoroughfares of the city are provided with overhead cables for lighting and motor service, which are being gradually extended into outlying areas. The generating station has a rating of about 5000 kw, the steam equipment being of British make and the electrical of German. The demand for energy for both lighting and motor service was so great that two years ago another generating station with a rating of 10,000 hp was decided on. The Central Argentine Railway supplies energy for its workshops from its own station.

The Buenos Aires & Pacific Railway Company, one of the most enterprising in South America, owns an important electrical generating station to supply energy to its shunting yards and workshops and to the docks. At first the equipment was limited to 3000 kw. This has not sufficed, and it has recently been added to by the erection of a new power house providing 5000 kw, by means of five 1000-kw, three-phase, 6000-volt generators, which are coupled to high-speed vertical engines. The addition includes no less than five substations, in four of which provision is made for step-down transformers. Rotary converters for the tramways are provided for in the fifth. In the town of Bahia Blanca, where these stations are located, a large railway system has been planned, providing six routes with an aggregate length of 24 miles. The first portion, consisting of 10 miles of single track, was completed some time ago. The South American Light & Power Company, in the same town, has from time to time found it necessary to extend its cables. About 75,000 8-cp lamps and 300 arc lamps for the thoroughfares are connected with its mains. The power house, which is located in a central position between the city and the port, has been designed for a 15,000-kw equipment.

Electrical installations in the republic date back twenty-seven years, beginning with the equipments of the River Plate Electricity Company at La Plata. During recent years extensions were found necessary, as the temporary installation of a 600-kw battery to take peak loads became quite insufficient. The additional plant consists of two 2000-kw turbo-generators. In the adjoining town of Tucuman the generating station was modernized a few years ago. In both towns the supply system is three-wire direct-current. Energy can be obtained from the River Lutes, which is capable of producing 50,000 hp. There are numerous large sugar factories within a radius of 30 miles in which the available energy can be utilized.

MULTIPLE-VOLTAGE ELECTRIC-TRACTION SYSTEMS.

An application filed in the Patent Office on April 1, 1905, by Mr. H. Ward Leonard, Bronxville, N. Y., and issued June 18, 1912, No. 1,029,698, relating to electric traction, is of unusual interest. The preamble of the specification states that the object of the invention is to provide means and methods for operating moving electrical vehicles over long distances by use of the high tension needed to secure economy and at the same time provide for operation through cities, towns, tunnels or other desired sections at a relatively low and safe tension. A number of different locomotive arrangements are covered, employing alternating-current high-tension energy supply and both alternating-current and direct-current low-tension supply, and with propulsion motors for either direct or alternating current, controlled in several ways. When direct-current propulsion motors are employed, with alternating-current supply, motor-generator sets are used on board the locomotive.

In the figure there is represented at 1 a high-pressure single-phase generator supplying the working conductors

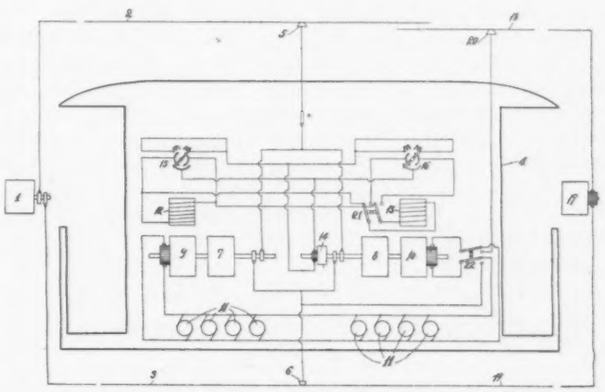

Diagram of Locomotive Circuits.

2, 3. The locomotive 4 carries the moving contacts 5, 6. The energy supply passes to two single-phase motors 7, 8, each directly connected to a generator 9, 10, preferably of the direct-current type. These low-pressure generators supply the propulsion motors 11, 11. The pressure in the motor circuit is regulated by varying the strength of the generator fields 12, 13, which are supplied from the separate generator 14, through the reversing rheostats 15, 16.

It may next be supposed that 17 is a source of low-tension direct-current energy supplying the working conductors 18, 19. When the train enters the low-voltage section the switch 21 will be thrown to the right, placing the field 13 under control of the rheostat 16. The latter may then be adjusted to relieve generator 10 of its load, which can then by means of switch 22 be connected to the low-tension supply through the contacts 20 and 6. Next the load may be transferred to the generator 10 and the high-tension supply be interrupted. The machine 10 will then act as a motor to drive 8 as a generator, supplying the motor 7, which drives the generator 9. Although the capacity will be cut in half on low-tension operation, the speed requirements through towns and cities will also be much diminished. Other arrangements and methods of control are also shown. The general principle of operation with several sections at different pressures, and also direct current in some sections and alternating current in others, has already been employed in a number of well-known instances.

This patent contains no less than 107 separate claims. A few of these will indicate the general scope of the invention. Claims 4 and 5 are as follows:

"4. The combination of an alternating-current supply circuit, a direct-current supply circuit, a vehicle, electric motors for propelling said vehicle, means on the vehicle for controlling the voltage of the energy supplied to at least one element of the propelling motors, and means on the vehicle whereby either the alternating-current supply or direct-current supply may be used for propelling the vehicle.

"5. The combination of a high-tension alternating-current supply circuit, an electrically propelled vehicle, a moving contact for leading energy from the high-tension circuit upon the vehicle, means on the vehicle for transforming such high-tension energy into lower-tension energy at a controllable electromotive force, propelling electric motors having at least one element supplied with such low-tension energy at a variable electromotive force for varying the speed of the vehicle, a source of direct-current energy, and means whereby the vehicle may be moved by electric energy from said source of direct-current energy, said means comprising an additional moving contact."

Claim 40 is singularly broad and is given next:

"40. The combination of two stationary sources of electric energy having different characteristics, an electric vehicle, and means whereby said vehicle may be electrically accelerated and electrically retarded while operated from either of said sources."

Claim 102 is also interesting because of its breadth:

"102. The combination of a source of high-tension energy, means comprising an electromotive force producing winding for deriving low-tension energy from said source, an electric motor, at least a part of said winding and at least one element of said motor being connected in series, means for varying the electromotive force in series with the said element for varying the speed of the motor, and a source of low tension adapted to supply energy to said element under certain operating conditions."

MEETING OF CENTRAL-STATION SALES MANAGERS.

The third annual convention of the sales managers of a few of the larger Edison companies was held at Association Island, N. Y., Aug. 5, 6 and 7. The chairman of the convention was Mr. R. S. Hale, of the Edison Electric Illuminating Company of Boston, and among those in attendance were Messrs. E. W. Lloyd, Commonwealth Edison Company; M. Ramsdell, Puget Sound Traction, Light & Power Company; J. D. Israel and H. K. Mohr, Philadelphia Electric Company; A. A. Pope, C. A. Littlefield and Miss Keinz, New York Edison Company; Messrs. T. I. Jones and M. S. Seelman, Edison Electric Illuminating Company of Brooklyn; L. R. Wallis and E. C. Kimball, Edison Electric Illuminating Company of Boston; P. H. Kemble, Toronto Electric Light Company; Miss S. M. Sheridan, Messrs. J. V. Oxtoby and E. J. Posselius, Edison Illuminating Company of Detroit; M. E. Turner, Cleveland Electric Illuminating Company; D. Burnett and C. E. Robertson, Consolidated Gas, Electric Light & Power Company, of Baltimore; F. D. Beardslee, Union Electric Light & Power Company, of St. Louis; J. F. Becker, A. F. Berry and F. W. Smith, United Electric Light & Power Company, of New York City.

As is very generally understood, none of the papers or of the discussions on them is given out for publication, since the meeting is more of a conference than a convention. However, the topics discussed were as follows: "Lamp Practice," "Shutting Down Isolated Plants," "Advertising and Follow-Up Methods," "Co-operative Methods," "Contract Order Routine," "Sales of Appliances," "Rates for Exclusive Summer Service," "Auxiliary and Breakdown Rates." On Wednesday afternoon immediately following the conference there was a game of baseball.

HEARINGS ON BALTIMORE CENTRAL-STATION RATES.

At further hearings before the Maryland Public Utilities Commission on the rates charged by the Consolidated Gas, Electric Light & Power Company, Baltimore, Md., Mr. Albert C. Ritchie, counsel on behalf of the people, continued the presentation of his case. Mr. Thomas J. Lindsay, a real estate expert employed in behalf of the public, testified that the company had overvalued its land and buildings by about $1,500,000, and he also showed that the company's valuation exceeded the assessed value for taxation by nearly $2,000,000. The company's total claim for intangible values is approximately $32,000,000, including an allowance of $22,000,000 for early losses. Members of the commission and counsel for both sides recently inspected several of the company's plants, including the Westport station, which is employed as an emergency reserve in case of failure of the energy supply from McCall's Ferry; the Gould Street station, near Port Covington, and the plant at Pratt and Penn Streets.

BUREAU OF FIRE PREVENTION IN CHICAGO.

By ordinance of the City Council, passed July 22, there has been created in Chicago a Bureau of Fire Prevention and Public Safety. The duties of this bureau are indicated by its title, and the ordinance goes into elaborate detail in laying down rules to prevent fires and to insure public safety. It is provided that one of the assistant fire marshals shall be chief of the bureau, while the office of fire-prevention engineer is created, with a salary of $3,000. This engineer is to have general control of the new bureau under the direction of the chief. Inspectors and other assistants are provided. Some of the provisions of the ordinance of especial interest to electrical men are as follows:

Electric lamps in the halls and lobbies of theaters, assembly rooms, dance halls, etc., shall be controlled by a separate switch located in an accessible place, subject to the approval of the chief of fire prevention. No fixtures shall be placed in the walls, woodwork or ceilings of theaters or public halls unless protected by fireproof materials. Border lamps must be constructed subject to the approval of the city electrician and suspended by a wire rope. Gas lamps, other than to indicate exits, shall not be permitted on the stage. The use of gas calcium lamps in any building used for the purpose of worship, instruction, theatricals or entertainment is prohibited.

A "garage," for ordinance purposes, is defined as a building or portion of a building "wherein are kept five or more automobiles or motor cars charged with or containing a volatile inflammable liquid for fuel or power." In such a garage generators and motors not actually a part of an automobile shall be located not less than 4 ft. above the floor. All incandescent lamps shall be protected by lamp guards, and no arc lamps shall be permitted. Portable incandescent lamps shall have keyless sockets. All electric switches and fuse blocks shall be placed at least 4 ft. above the floor.

In dry-cleaning establishments in which gasoline, naphtha, etc., are used the artificial lighting must be by incandescent electric lamps with keyless sockets. No open flame of any kind is allowed.

Careful and exact rules are made for the construction and installation of boilers, furnaces, chimneys, flues and the like.

The manufacture, transportation, storage, sale or use of liquefied acetylene is prohibited within the city.

Coal-gas producers must be of an approved type. Suction-type producers must be placed in fireproof rooms, and pressure-type producers must be installed in separate buildings.

Egg candling shall be done only by electric light.

In thawing out frosted pipes open flames must not be used. Each electric flatiron and electric glue-pot shall have a cut-out and an indicating switch. An incandescent lamp of low candle-power shall be connected in multiple with the heaters. Stands must be provided to maintain a 3-in. clearance between the bottom of electric irons and combustible material.

This important ordinance embraces a total of eighteen articles and 291 sections, many of the latter being divided into sub-sections.

RATE REVISION IN CHICAGO.

The sub-committee of the City Council committee on gas, oil and electric light which is considering the question of revising the rates of the Commonwealth Edison Company has had several informal conferences with representatives of the company. The five-year contract between the city and the company fixing maximum rates has expired, and the question now comes up of adjusting the rates for the next five years. The company contends that because it has voluntarily reduced rates below those permitted by the ordinance its existing rates should be allowed to stand for the next five years, being in fact a reduction as compared with the legal rates for the five-year term just expired. So far as the ordinance goes, the company could now be charging a maximum rate of 12 cents per kw-hr. and a secondary rate of 6 cents, whereas the actual tariff is 10 cents maximum and 6 cents secondary, while the company has announced a reduction of the secondary rate to 5 cents, effective Oct. 1, 1912. These reductions, made by several successive steps, have been purely voluntary on the part of the company.

In its preliminary study the sub-committee of aldermen has been puzzled somewhat by the technical terms and the two-rate system of charging, the turning point in Chicago being after thirty hours' use of the maximum demand. It has called the city electrician to its assistance, and he, with the co-operation of the company, will prepare a pamphlet explaining the usage in non-technical language. Further, the sub-committee has agreed to recommend that the city electrician (Mr. Ray Palmer) be authorized to make a preliminary investigation, with the aid of an experienced accountant from the city comptroller's office, to verify the figures and statements made by the company. The company has promised all possible aid in making this preliminary investigation. After the city electrician's report has been made it will be determined whether a more elaborate investigation, perhaps with the aid of outside experts, will be necessary.

GRADUATE WORK IN ENGINEERING AT THE UNIVERSITY OF ILLINOIS.

The increasing demand for engineering training beyond that obtainable in the usual four-year course is constantly receiving more recognition by the technical schools and universities over the country. Graduate courses in engineering, leading to degrees of master of science or doctor of philosophy, are now offered at the University of Illinois, and a number of men are taking the work which leads to these degrees. The graduate work in electrical engineering embraces courses in advanced alternating-current theory, electrochemistry, central-station economics, thermodynamics, engineering design and mathematics. The work in alternating-current theory covers commutator motors, transient phenomena in electric circuits and precision measurements, which is taught both in the classroom and the laboratory. Perfect familiarity with the oscillograph is considered very important in connection with the experimental study of transient phenomena. Instruction in electrochemistry is given by means of lectures and demonstrations. Central-station economics is taught in a short course which takes up the calculation of practical problems, the choice of prime movers, proper steam pressures, superheat, feed-water temperature, etc. The course in thermodynamics covers the whole fundamental theory of perfect gases, saturated and superheated steam, gaseous mixtures and the flow of gases, passing finally to steam turbines, internal-combustion engines and refrigeration machines. Engineering design covers the dynamics of machinery, theory of governors, shaft stresses, flywheels, etc. The work in mathematics commences with a short review of calculus and then embraces a study of the important differential equations encountered in engineering. Every candidate for a degree is required to give considerable time to original research, to be incorporated in a thesis. Nineteen students are now enrolled in the graduate electrical department, which is in direct charge of Dr. E. J. Berg.

HYDROELECTRIC ENLARGEMENTS AT TURNERS FALLS, MASS.

The Turners Falls (Mass.) Power Company, operated by the Cabot interests of Boston, is planning the construction of a hydroelectric plant on the Connecticut River which will have an ultimate capacity of 40,000 hp. The new installation will be located about 2 miles southeast of the present hydroelectric station of the company in Turners Falls, the capacity of the latter having been nearly reached through the development of the company's wholesale business. It is intended to increase the size of the original 10 ft. by 50-ft. canal of the old plant to 18 ft. by 130 ft., and to extend it to the new power-house site, where the water will be used under a 60-ft. head. The new canal will carry about 7000 cu. ft. per second, which is the rate of flow of the Connecticut River for eight months, on an average year, from a drainage area of 7000 sq. miles above the Turners Falls dam. Work on the canal is already under way and the plans for the power house are completed. A new 1500-kw unit has lately been installed in the old Turners Falls plant, and the Easthampton Gas Company, controlled by the same interests, is completing the installation of a 3000-kw steam turbine unit with condensing and boiler equipment at the Mount Tom station, in order to handle the rapidly increasing load offered by the West Boylston cotton mills and the Mount Tom Sulphite Paper Company. The Mount Tom station, which was described, together with the 22,000-volt steel-tower transmission line of the Amherst Power Company, in the *Electrical World* of Sept. 9, 1911, will be operated as a steam auxiliary plant in connection with the Turners Falls installations upon their completion. The line was designed for operation at an ultimate pressure of 66,000 volts. It is stated that when the project is completed it will be the second largest hydroelectric development in New England.

ELECTRICAL CONSTRUCTION IN BOSTON.

Substantial progress in electrical applications in Boston during the past year is indicated by the recently published report of Wire Commissioner Cole for the fiscal year ended Jan. 31 last. There was a larger amount of underground electrical construction during the year than ever before, the amount installed being more than two and one-half times

that of any year in the past decade. Exclusive of the increase in electrical output in Boston due to the annexation of Hyde Park, there were the following increases in the systems of public-service corporations: Boilers, 9605 hp; engines, including steam turbines, 64,735 hp; incandescent lamps, 85,475; arc lamps, 841; motors, 2152, with a total rating of 21,711 hp. All high-potential circuits are now to be placed underground within the city limits, and by the terms of Chapter 364, Acts of 1911, the commissioner is authorized to prescribe the placing of wires underground in 5 miles of street a year, 2 miles a year having been the former requirement. During the year the department removed 171,235 ft. of wire and the owners of electrical installations removed 1,956,428 ft. of wire from overhead service. There were 27,756 overhead inspections, 5310 defects reported and 3694 defects corrected.

The statistics of the department show that the underground services in Boston include 1,942,999 ft. of conduit, 12,363,352 ft. of single duct, 15,328,304 ft. of cable, 8675 manholes, 19,117 service connections and 617,618 ft. of Edison three-wire tube, with 646 Edison distribution boxes. In 1911 the Edison Electric Illuminating Company of Boston installed 720,175 ft. of cable, the Boston Elevated Railway Company 223,961 ft. and the New England Telephone & Telegraph Company 163,840 ft. The overhead electrical distribution systems of Boston now include 36,936,763 ft. of wire and 16,631 poles. The total rating of engines and turbines in public-utility isolated and block plants at the end of the year was 294,128 hp, the Boston Edison company and the Boston Elevated company having about 119,000 hp each. In isolated plants were engines having a combined rating of 50,736 hp. Isolated plants gained only 64 hp in the year, compared with a gain of 67,939 hp in public-utility plants. There are only 324 isolated plants in Boston now, compared with 344 a year ago. Including the street-railway service, there are now 22,858 electric motors in use in Boston, with ratings aggregating 365,217 hp. During the year the department received 15,765 notices of new work, as against 13,986 notices a year ago, and made 32,480 inspections, compared with 29,949 in 1910. Insurance losses during the year from fires found by the department to be due to electrical causes were small, as, excluding one fire causing a loss of about $10,400 which was attributed to electrical causes, though this could not be proved, insurance losses amounted to less than $800. The report contains the usual analysis of electrical accidents, showing only two electrical fatalities.

THE SOUTHERN SIERRAS POWER COMPANY.

The Southern Sierras Power Company, a subsidiary company of the Nevada-California Power Company, of Denver, Col., has about completed a double, three-phase, high-tension, steel-tower transmission line northward from its San Bernardino (Cal.) plant, through the Owens River Valley for a distance of 236 miles to Bishop (Inyo County), where the company has two hydroelectric developments with an aggregate rating of 4000 hp.

The Southern Sierras Power Company owns and operates a 5000-hp steam turbo-generating and distributing system at San Bernardino, the distributing system at Corona (Cal.) and also an 80-mile distributing system covering the San Bernardino, Riverside, Corona, San Jacinto and Perris Valley districts, embracing in this territory a thickly settled community of at least 50,000. The hydroelectric stations are on Bishop Creek, a tributary of the Owens River. One of the stations in operation has a rating of 2000 hp, while another, of the same rating, is under construction and will be shortly completed. As soon as reservoir No. 2 of the Nevada-California Power Company is completed the equipment in these plants will be augmented so that an aggregate output of 6000 hp will be available.

In addition, the Nevada-California Power Company owns and operates the complete hydroelectric system of two plants on Bishop Creek, with a third under construction. It also possesses two power sites which it proposes to develop in the near future. There are thus five stations in operation with an aggregate rating of 34,000 hp.

The new line is designed for 140,000 volts. The towers

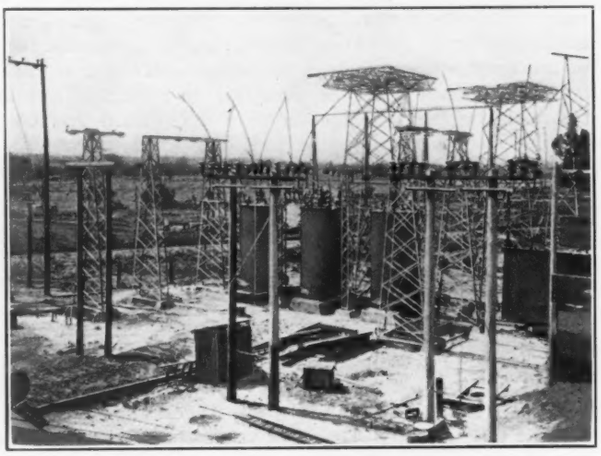

Fig. 1—Outside Transformer and Switching Station.

are 70 ft. high, and at first energy will be transmitted at a tension of 60,000 volts, it being expected that eventually the line will be operated at 100,000 volts as a standard, although the transformers and the transmission system are capable of operating at 140,000 volts. The company has also installed a number of outdoor transforming and switching stations, the outdoor station at San Bernardino being shown in Fig. 1. This station has a rating of 16,000 kw.

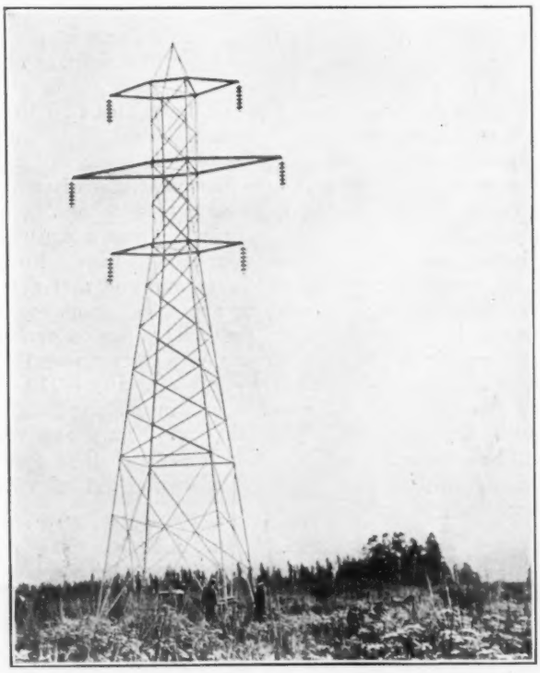

Fig. 2—100,000-Volt Tower Line from Bishop to San Bernardino.

A steel-core stranded aluminum cable will be used on the transmission system. The engineers of the company are Messrs. Manifold and Poole, Los Angeles. The officers of the Southern Sierras Power Company are as follows: Mr. G. S. Wood, president; Mr. Delos A. Chappell, vice-president and general manager; Mr. Lawrence C. Phipps, Jr., treasurer, and Mr. William E. Porter, secretary.

PUBLIC SERVICE COMMISSION NEWS.

NEW YORK COMMISSION, FIRST DISTRICT.

The Public Service Commission, First District, has granted the Hudson & Manhattan Railroad Company (the McAdoo tubes) an extension of time to April 28, 1914, in which to begin construction of the proposed tunnel extension from Thirty-third Street and Sixth Avenue to the Grand Central Station.

The commission has issued an order granting the Kings County Lighting Company permission to issue $625,000 in bonds, maturing July 1, 1954, and redeemable Jan. 1, 1940, at 105 and accrued interest. These bonds will bear interest at 5 per cent, payable semi-annually. The permission is given on the condition that the bonds shall be sold so as to net the company not less than 96 per cent of the par value, besides accrued interest.

Hearings were resumed on Aug. 6 before Commissioner Maltbie on the complaint of certain customers of the Edison Electric Illuminating Company of Brooklyn that discriminatory rates are given by the latter to large users of energy. Testimony at this hearing centered upon the legality of furnishing conjunctional service whereby one tenant on a block makes a blanket contract with the central-station company for his electrical needs and those of his neighbors, thus obtaining a form of contract at a wholesale rate which enables him to resell the energy to his neighbors at a price lower than that which each could obtain individually from the company.

According to testimony given by Mr. Percival R. Moses, a consulting engineer who appeared for the complainants, a plant in a business building was enlarged in keeping with his designs, and an agreement was made between the owners of the plant and nearly all the business houses on the block to supply them with energy at rates about 15 per cent under those being paid to the Edison company at that time. Maintenance and supervision of the plant were cared for by an engineering supervision company in which Mr. Moses is interested. After several months' trial, the cost of supplying this service was found to be greater than the cost of an equivalent amount of energy from the Edison company. A contract was then made with the latter by the owners of the plant, which was shut down. Details of the matter were printed in the *Electrical World*, June 15, 1912, page 1313.

The complainants hope to show from this testimony that to permit such grouping of interests to obtain low rates opens the way for discrimination against customers of the central-station company who are unable to form such neighborhood associations.

Mr. Theodore I. Jones, general sales agent of the Brooklyn Edison company, was examined upon various forms of contract used by his company. He brought out the point that persons who buy energy from customers of the Edison company are not themselves customers of the company. The latter, he contended, is therefore not concerned in the rates for electric service paid by such persons. The hearing was adjourned until the middle of September.

NEW YORK COMMISSION, SECOND DISTRICT.

The Public Service Commission, Second District, has just completed a thorough investigation of the street-railway conditions in the city of Buffalo which has been carried on continuously since February. All the lines in that city are operated by the International Railway Company. The work was done under the direction of the commission's street-railway inspector, Mr. Charles R. Barnes.

Sweeping changes in the routing of cars designed for the convenience of the public passing from the east to the west side of Main Street and vice versa, better service to residential districts and better service to the railroad stations are recommended in the report. The recommendation for the rerouting of cars will break up the division, so far as traffic is concerned, of the east and west sides. The report says that this division in most elements affects the prosperity of the city and is as complete as if made by a Chinese wall, that no one element contributes more to the division of the city than the routes on which cars have been run, and that if the efforts of the company had been especially directed to maintaining the division of the city it is doubtful if it would have accomplished greater results in this direction. The transfer system is sharply criticised, and it is stated that people of the city of Buffalo are walking and carrying the company's transfers approximately 2760 miles each working day, there being 20,000 people employed on the opposite side of the city from that in which they live.

The report recommends the reconstruction of 29 miles of track, the repair of 80 miles, the reconstruction of a large amount of special work, the immediate reconstruction of a large amount of equipment, the placing of route and destination signs on the cars, the better cleaning and overhauling of cars and the withdrawal of flat-wheel cars; that as soon as 300 new cars which have been ordered are received no single-truck cars be operated on the principal lines; that an electrical survey of the tracks be made; that cars no longer be stored upon the principal streets; that stop signs be installed, and immediate steps taken to reduce the number of car collisions in the city; that greater attention be given to instruction of motormen and conductors; that the companies designate an official whose principal duties shall be the investigation of complaints, suggestions and matters of mutual interest to the people and the company; that the company increase the efficiency of its lost and found department, and that the company make a closer analysis of travel and service and periodical counts of passengers, which should be recorded on graphic charts for all lines and all hours.

In addition to the recommendations directed to the company's attention, suggestions are made to the municipal authorities as to the necessity for ordinances and regulations which will assist the company in furnishing proper service. A copy of the report has been served upon the International Railway Company without any order or direction of any kind, it being the purpose of the commission to give the company a reasonable time in which to give careful study to the conclusions and recommendations which have been made.

OHIO COMMISSION.

On the complaint of the United Telephone Company the courts have issued a temporary restraining order preventing the Logan County Farmers' Telephone Company from building a toll line between West Liberty and Degraff, on the ground that no certificate of public necessity has been secured from the Public Service Commission. The United Telephone Company operates exchanges at both points and a toll line between them.

MICHIGAN COMMISSION.

The hearing on the application for authority to consolidate the Home Telephone Company of Detroit with the Michigan State Telephone Company took place before the Michigan Railroad Commission on July 31. But little objection was made to the application, although much was anticipated. The Detroit Board of Commerce protested against any plan that will disturb the private exchanges placed in business houses by the Home Telephone Company or by themselves.

The order prepared at the request of the Railroad Commission was agreed upon by a committee composed of the following: Attorney Lyons, representing the Independent Telephone & Traffic Association; Attorney Beckwith, representing the Valley Telephone Company of Bay City; Attorney Stewart, representing the Citizens' Telephone Company of Grand Rapids; Judge Murfin, representing the Bell interests, and Corporation Counsel Lawson of Detroit.

The order provides that the independent companies now in operation and to be formed in the future shall have long-distance service and connections as in the past. The company may not increase rates without the consent of the Railroad Commission and all contracts with the independent companies must be carried out.

In the portion of the State bounded by Imley City and Lapeer on the north, by Flint and Lansing on the west and by an arc of a circle from Lansing to the state line on the south, the Michigan State Telephone Company will have complete control in the future. No other company may establish an exchange and expect long-distance service until the Michigan State company decides that it will not establish an exchange at the point under consideration. After that the rule applies that an independent shall have long-distance service as in other portions of the State.

WISCONSIN COMPANY.

The Wisconsin Railroad Commission has dismissed the complaint of the city of Janesville against the Rockford Interurban Railway Company. The complaint alleged that by reason of the fact that the defendant had recently suspended service on certain streets the passengers had been inconvenienced and had been denied the benefit of a reduction in fare recently ordered by the commission; also that the service was deficient on account of inadequate station capacity. The commission held that the company was rendering service in substantial compliance with the terms of its franchise; also that, through an arrangement between the interurban and the city companies, the service along the old route of the interurban was reasonably adequate. No opinion was expressed upon the general adequacy of the service, which is held subject to further investigation at a subsequent proceeding.

The Ashland Home Telephone Company has been authorized to increase its revenues by raising the rate on single-party service from $1 per month to $1.60 per month. Permission was granted to introduce two-party and four-party service with rates of $1.35 and $1.10 respectively. The schedule of rates as petitioned for was not granted because it would mean a 12.5 per cent rate of return upon the reproduction cost of the plant. The revenue which will be derived under the commission's schedule is supposed to be sufficient to provide for a 6.5 per cent depreciation fund and a 7 per cent return on the reproduction cost.

Current News and Notes

Denver Electrical Wiring Ordinance.—The present electrical ordinance of Denver, Col., is being recodified by the city electrician, Mr. John Malm. New rules covering motor inclosures, size and fusing of motor leads, permission for use of armored cable for fished work and other things will be included. A board of engineer examiners will be appointed to examine and pass on candidates for licenses to do wiring. Some changes will be made in present license and inspection fees.

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Canadian Hydroelectric Developments.—In the description of the system of the Canadian Light & Power Company which was published in the Aug. 3 number an error was made in stating the size and breaking weight of the copper-clad cables crossing the St. Lawrence River. The main circuits are 13/16-in. copper-clad cable and the telephone circuit 5/8-in. cable. The actual breaking weight of the cables is 30,000 lb. and 20,000 lb. respectively and not per square inch as stated.

* * *

Western Union Employees Vote on Insurance Plan.—President Theodore N. Vail of the Western Union Telegraph Company will call upon the company's employees to vote on the question whether the company shall adopt a life-insurance system or a plan of payment in case of temporary disability. Blank voting forms were sent to the employees of the company on Aug. 6. Officers of the Commercial Telegraphers' Union of America report that it has been decided to instruct all telegraphers not to vote on the plan, inasmuch as the benefit is said to amount to but 50 cents a month.

* * *

Outing of Central-Station Employees.—All of the women employees of the Commonwealth Edison Company of Chicago were guests of the company at the annual "ladies' day" outing held at Delwood Park, near Joliet, Ill., on Aug. 3. In addition, each lady was allowed the leap-year privilege of inviting one man, provided the person thus signally honored was an employee of the company. The party took electric cars at 1 p. m. for the amusement park, and the afternoon and evening were passed pleasantly in various amusements. The company entertained the merry-makers at dinner. The closing feature was a dance. Mr. George B. Foster was master of ceremonies.

* * *

A List of Living "Immortals."—Mr. W. T. Larned, secretary of the Modern Historic Records Association, has written to the New York *Sun* in relation to the preparation of a list of "all the living men and women of recognized genius in every department of human activity." To him, he says, has been assigned the task of compiling such a list, and he gives over a hundred names, with, as might be expected, "considerable diffidence." In Mr. Larned's tentative list occur the names of the following: Professor Arrhenius, Alexander Graham Bell, Sir William Crookes, Mme. Curie, Thomas A. Edison, Finsen, Marconi, Professor Michelson, Sir William Ramsay, Lord Rayleigh, Professor Roentgen, Professor Rutherford, Charles P. Steinmetz, Sir J. J. Thomson, Nikola Tesla, Elihu Thomson and George Westinghouse.

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Pulmotors for Byllesby Properties.—Mr. Arthur S. Huey, vice-president in charge of operation for H. M. Byllesby & Company, has ordered ten additional pulmotors for installation in the company's gas properties. When these oxygen resuscitation machines are installed there will be a total of twenty-one in use, all the gas properties being so equipped. The first eleven pulmotors ordered by Mr. Huey were installed at Pueblo, Col.; St. Paul, Minn.; Fort Smith, Ark.; Mobile, Ala.; Muskogee, Okla.; Oklahoma City, Okla.; Eugene, Ore.; San Diego, Cal.; Stockton, Cal.; Tacoma, Wash., and Louisville, Ky., and are reported to have been responsible for the saving of at least three lives, two at Louisville and one at Pueblo. The first case was one of electric shock, the second was gas poisoning and the third was the case of an infant swallowing morphine tablets. In all three cases the attending physicians had pronounced the patients beyond aid before the pulmotor was applied.

* * *

British Association for the Advancement of Science.—The 1912 meeting of the British Association for the Advancement of Science will be held in Dundee from Sept. 4 to 11. The president for the year is Dr. E. A. Schafer, F. R. S., who has been professor of physiology at the Edinburgh University since 1899. He was general secretary of the association from 1895 to 1900. Among the events will be an evening discussion by Prof. W. H. Bragg on "Radiations Old and New." The following are the presidents of the sections relating to engineering and allied subjects: Mathematical and physical science, Prof. H. L. Callender; chemistry, Prof. A. Senier; economic science and statistics, Sir Henry H. Cunninghame; engineering, Prof. A. Barr; educational science, Prof. J. Adams, and agriculture, Prof. T. H. Middleton. Agriculture forms the subject of a full section for the first time, a fact not without interest in view of the greater attention now being paid to the application of electricity to this branch of industry.

RATE RESEARCH BULLETIN TO BE PRINTED.—The executive committee of the National Electric Light Association has authorized the rate research committee of the association to print an edition of perhaps 1000 copies of the weekly *Rate Research Bulletin*. A limited number of copies of this bulletin have been issued in the past by a duplicating process, but the result has not been entirely satisfactory in a mechanical sense, while the demand has exceeded the supply. Beginning next month, therefore, printed bulletins will be issued. It is probable that a subscription price will be charged to others than the members of the committee and the company advisers of the committee.

* * *

STANLEY ANTI-TRUST BILL.—Representative Stanley, chairman of the steel investigating committee of the House of Representatives, has presented a new anti-trust bill, which provides that the capital stock of corporations shall be fully paid in cash, property or services at actual value, and that no corporation shall have power to acquire or hold stock of another concern. Interlocking directorates are prohibited and a limit is placed on the amount of stock that any officer or director of one corporation may hold in a competing company. If two or more corporations shall have been combined in ownership through the holding of their stock by another corporation on or after August 12, the combination shall be dissolved.

* * *

ELECTRICAL CODE OF CHICAGO.—The "Rules and Regulations of the Department of Electricity of the City of Chicago" have recently been entirely revised, and the edition of 1912 has just made its appearance. These rules provide for the installation of wires and electrical apparatus for electric light, heat and motor service and for the construction and installation of electric signs and displays. In their present form they are very similar to the latest edition of the National Electrical Code, with such modifications and additions as are made necessary by the local situation. The Chicago Code makes a book of 207 pages and bears the names of Mr. Ray Palmer, city electrician, and Mr. Victor H. Tousley, chief electrical inspector.

* * *

WIRELESS STORM WARNINGS AT SEA.—It is announced that Chief Willis L. Moore of the United States Weather Bureau expects much from the plan formulated at the International Wireless Conference at London which will give to weather reports the right-of-way at sea over all other wireless messages excepting calls for help in emergencies. According to the agreement, each government will secure its own observers, take its own observations and pay service tolls. By the international exchange of observations after the wireless convention shall be ratified by the several governments represented at the conference, it is predicted that the construction of a daily weather map for both the Atlantic and Pacific oceans will become feasible.

* * *

CENTRAL-STATION TELEPHONE SERVICE.—In large central-station companies the telephone service is an almost essential feature of the business and one that assumes large proportions. The principal telephone switchboard of the Commonwealth Edison Company of Chicago, for instance, had a traffic record of about 13,000 connections in twenty-four hours during the month of May, 1912. This is an increase of about 116 per cent in the volume of telephone business in a period of four years. The equipment consists of a ten-position switchboard with an auxiliary two-position board designed to help out during the hours of the peak. Seventeen telephone operators are employed at this private exchange, and they are divided into shifts to insure continuous service day and night.

* * *

CRACKING OF CONCRETE STRUCTURES.—The National Bureau of Standards in its general investigation of structural materials is engaged, among other things, in the determination of the physical properties of concrete. At the suggestion of engineers and others, the Bureau is investigating the cause of cracking in concrete structures, where the necessity for expansion and contraction joints is questioned. For this purpose, reference marks were placed not long ago on some of the typical old and new concrete work in Wayne County, Mich., also at Greenwich, Conn. Measurements will be taken from time to time during the summer and winter to determine the expansion or contraction in the concrete caused by temperature variations and the changes of volume which take place during hardening. Similar reference marks are being placed on the lock walls of the Panama Canal and various other structures from which valuable information will be obtained.

* * *

PROGRESS OF AMERICAN COMMERCE AND INDUSTRIES.—Ten years ago Mr. O. P. Austin, chief of the Bureau of Statistics, Department of Commerce and Labor, delivered before the American Association for the Advancement of Science an address on "The Progress of American Commerce and Industries" which created wide interest at the time. The statistics then presented have been brought down to date and the subject matter of the address has been revised and was printed in the *Congressional Record* of July 17, 1912. The revised address covers the material progress of the nation from 1870 to 1912. The foreign commerce of the United States has grown from less than $1,000,000,000 in 1870 to practically $4,000,000,000 in 1912. In the meantime the internal commerce of the country has grown from $7,000,000,000 to $33,000,000,000. Copies of the pamphlet containing the address can be obtained from the Government Printing Office, Washington, D. C.

* * *

STRENGTH TESTS OF CROSS-ARMS.—A bulletin on this subject was recently issued by the United States Department of Agriculture, being Circular No. 204 of the Forest Service. A summary of the results concludes with the statement that, taking all things into consideration, cross-arms of the species and dimensions tested are strong enough for ordinary use, but when longer arms are employed the strength is relatively of much more importance. In the case of standard 6-ft. cross-arms, however, the question of strength need not enter into calculations of line construction, except in the comparatively infrequent cases of abrupt changes in grade. The resistance of timber to decay and the methods of preventing decay are considerations of greater importance. Government publications are deposited with the Superintendent of Documents, Washington, D. C., and are available for distribution upon payment of a nominal charge, the amount of which can be learned upon application.

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ELECTRICAL OPERATION OF SEWAGE-PUMPING STATION.—Work is now in progress on the installation of an electrical pumping outfit in the sewage-pumping station of the city of Chicago at Fullerton Avenue and the North Branch of the Chicago River. A marked economy will result by the substitution of a 75-hp alternating motor driving a screw pump for an old steam pumping engine. Electrical energy will be furnished by the Sanitary District of Chicago over a three-phase, 60-cycle circuit from the H. N. May substation of the city street-lighting system, also operated under contract by the Sanitary District, utilizing the hydro-electric energy from the Chicago Drainage Canal. The city agrees to pay at the rate of $2.20 per hp per month for maximum requirements for twenty-four-hour service. The maximum demand is determined by the average of the three highest five-minute readings taken from curve-drawing instrument records. In addition there is a flat charge of $7.50 a month to cover fixed charges for the Sanitary District's investment and maintenance.

Wireless Communication with Germany.—The new wireless station at Nauen, near Berlin, Germany, which is to replace the tower blown down in a terrific storm last March, is now approaching completion. The new tower is nearly 900 ft. in height, and it is anticipated that its radius of action will include New York City.

* * *

Pacific Wireless Service.—The Federal Telegraph Company has inaugurated regular wireless commercial service between San Francisco and Honolulu, a distance of 2350 miles. The company operates along the Pacific Coast and as far east as Chicago and Kansas City. The Honolulu station is located 12 miles outside of the city; the San Francisco station, situated at San Bruno Point, is 10 miles from the city and is equipped with two 440-ft. towers placed 600 ft. apart.

* * *

Recommendations of London Wireless Telegraph Conference.—Recommendations were adopted at the London International Conference on Wireless Telegraphy that the following problems be studied during the period before the next conference in 1917: First, the development of a standard wave meter; second, the selection of a standard decrement; third, the development of a standard receiving apparatus for comparing the intensities of waves received from different sources.

* * *

Iron and Steel Tariff.—On Aug. 5 the iron and steel tariff bill received the signatures of Speaker Clark of the House of Representatives and Acting-president Bacon of the Senate. It then went to President Taft for his consideration. This is the first of the tariff revision bills passed by the so-called Democratic-Progressive alliance in the Senate to reach the President. It is generally forecast that Mr. Taft will veto this bill because no investigation of the industry has been made by the Tariff Board to serve as a basis for scientific revision.

* * *

Foreign Markets for Motor Vehicles.—The United States Bureau of Manufactures has issued a monograph entitled "Foreign Markets for Motor Vehicles." The publication is a compilation of reports from American consuls stationed in every part of the globe and is arranged with the particular end in view of aiding American manufacturers to extend their foreign sales. It describes the peculiarities of the various markets, special local conditions and prejudices to be considered, foreign competition to be met and the best methods of selling cars.

* * *

The Engineer in City Planning.—The July issue of the *Proceedings* of the Engineers' Club of Philadelphia contains an interesting paper entitled "The Engineer in His Relation to the City Plan," the author of which is Mr. Nelson P. Lewis. The paper discusses the general purpose of city planning and its economic advantages and also recounts briefly the progress which has been made in this and other countries. The club *Proceedings* is published quarterly from 1317 Spruce Street, Philadelphia, Pa. The secretary is Mr. W. P. Taylor, to whom any persons desiring copies of these *Proceedings* should address themselves.

* * *

Decision in Favor of Toronto & Niagara Power Company.—The judicial committee of the Privy Council of London, England, on July 24 reversed the judgment of the Court of Appeal of Ontario, Canada, delivered on Feb. 1 of this year, in the case of the Toronto & Niagara Power Company. The Privy Council finds that the company is entitled to erect poles and string wires along the streets of North Toronto for the distribution of electric power without the consent of the city of Toronto. The company recently decided to expend $3,000,000 in extensions of its system at Niagara, whereby four new generating units will be installed in the Niagara Falls station in addition to the three 8500-kw units being erected, bringing up the total capacity to 125,000 hp. The proposition in regard to which the company and the corporation of the city of Toronto came into conflict was that of the erection of a transmission line from Niagara to the city, to operate at a pressure of 85,000 volts.

* * *

Wireless Telegraphy Without Antennas.—Very interesting experiments in wireless transmission have recently been carried on in Berlin without antennas, employing a new arrangement devised by Prof. Zehnder. An ordinary insulated conductor, supported on telegraph poles, is connected at each end to the ground, with or without intermediary condensers, which becomes the substitute for the antenna. The total length of wire should not exceed one-half of the wave-length at the frequency employed. This conductor is excited in the usual manner near its center by a Braun vibratory circuit which is tuned to resonance. Employing this scheme, telegrams were transmitted several hundred miles without the use of antennas and with small-sized sending apparatus. It has been discovered that this arrangement possesses a selective action in reference to the direction of transmission. The most favorable direction is that of the wire itself. Radiograms have been satisfactorily transmitted with this equipment from Berlin to Norddeich, and with the ordinary type of receiver messages have been received in Berlin from Glace Bay, Nova Scotia, across the Atlantic.

* * *

SOCIETY MEETINGS.

Vermont Electrical Association.—The eleventh annual meeting of the Vermont Electrical Association will be held at Rutland, Vt., Sept. 12 and 13. The secretary-treasurer is Mr. A. B. Marsden, Manchester, Vt.

* * *

Schenectady Section, A. I. E. E.—The following have been elected officers of the Schenectady Section of the American Institute of Electrical Engineers: Dr. C. P. Steinmetz, honorary chairman; J. B. Taylor, chairman; Messrs. J. L. Burnham, H. W. Peck and C. M. Davis, vice-chairmen; Messrs. C. H. Reid, W. Stewart Clark, J. J. Linebaugh and C. Lichtenberg, managers; Mr. J. A. Dewhurst, secretary, and Mr. W. S. Bralley, treasurer.

* * *

International Association for Testing Materials.—Further information concerning the sixth congress of the International Association for Testing Materials, to be held in New York City Sept. 2-7, is set forth in committee circular No. 4, under date of August, 1912. This circular contains announcements by the executive committee regarding membership fees, registration, admission to sessions, session rules and procedure. The headquarters are at 29 West Thirty-ninth Street, New York City.

* * *

Formation of California Association of Electrical Inspectors.—At the recent convention of the California Electrical Contractors' Association a new organization was formed which will be known as the California Association of Electrical Inspectors. This organization will be a branch of the national association. The following officers were elected: President, W. A. Spencer, San José; secretary, Edward W. Jewell, San Diego; treasurer, P. A. Anderson, Oakland, Cal. Messrs. E. N. Beecher, chief electrical inspector of San Diego, and C. W. Mitchell, of the Board of Fire Underwriters of the Pacific Coast, were named as a committee to work for the enlargement of the membership before the next annual convention. The object of the new organization is to promote co-operation between inspectors and contractors and to advocate uniform inspection.

AUXILIARY ELECTRIC SERVICE AT ROME.

Steam-Turbine Station Operated in Conjunction with Two Hydroelectric Stations During Peak Loads and Emergencies.

Plant Equipped for Efficient Operation and Low Labor Cost. —Auxiliary Apparatus Electrically Driven— Provisions for Rapid Start from Stand-Still.

THE San Paolo steam-turbine station was designed to supply energy for electric lighting and motor service in the city of Rome, Italy. It is located in the suburbs of the city on the bank of the Tiber. Hydraulic power in the neighboring region is also used in the Tivoli and Subiaco plants, but as the demand for energy has increased within recent years it was found necessary to erect a new station for this purpose. The steam plant is very useful during the hours of heavy load, and it affords the additional amount of energy needed.

For the initial plant there were installed two 5000-hp Curtis steam turbine sets, together with boilers equipped with automatic stokers. Quite recently the station has been doubled in equipment by adding a 10,000-hp Curtis turbine set. The first steam turbines were of the vertical-shaft type with the turbine placed below and the alternator at the top, while the new group is horizontal, the turbine being on the same horizontal shaft with the alternator.

In the boiler house used for the two 5000-hp sets there are erected two ranges of boilers lying on either side of the middle space, laid out in three groups of two boilers each. The six boilers on a side use a common smoke flue and stack. Each of the boilers has 3200 sq. ft. of heating area and is designed to give from 10,000 lb. to 12,000 lb. of steam at 200 lb. per square inch on the average, but they can be run at 20 per cent above this when desired. For each boiler there is used a superheater having a heating surface of 670 sq. ft. so as to raise the temperature of the steam to 300 deg. C. An economizer is built with each boiler so as to make up a complete unit.

The automatic stoking system and the coal-handling devices are well designed so as to necessitate as little hand labor as possible in the station. A coal yard is laid out in the rear of the boiler room, and the coal is picked up by a bucket carried on an electric crane and dropped into a hopper which feeds an endless bucket conveyor. This conveyor runs on an upper level and it enters the boiler room and drops the coal into a set of bunkers placed in the upper

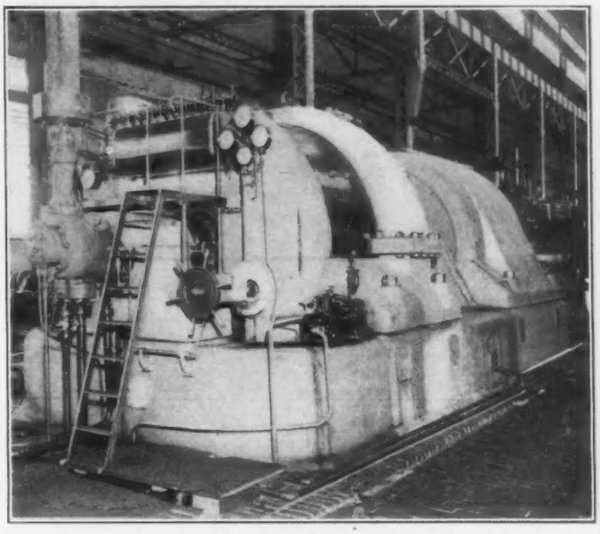


Fig. 2—New Horizontal 10,000-hp Turbine.

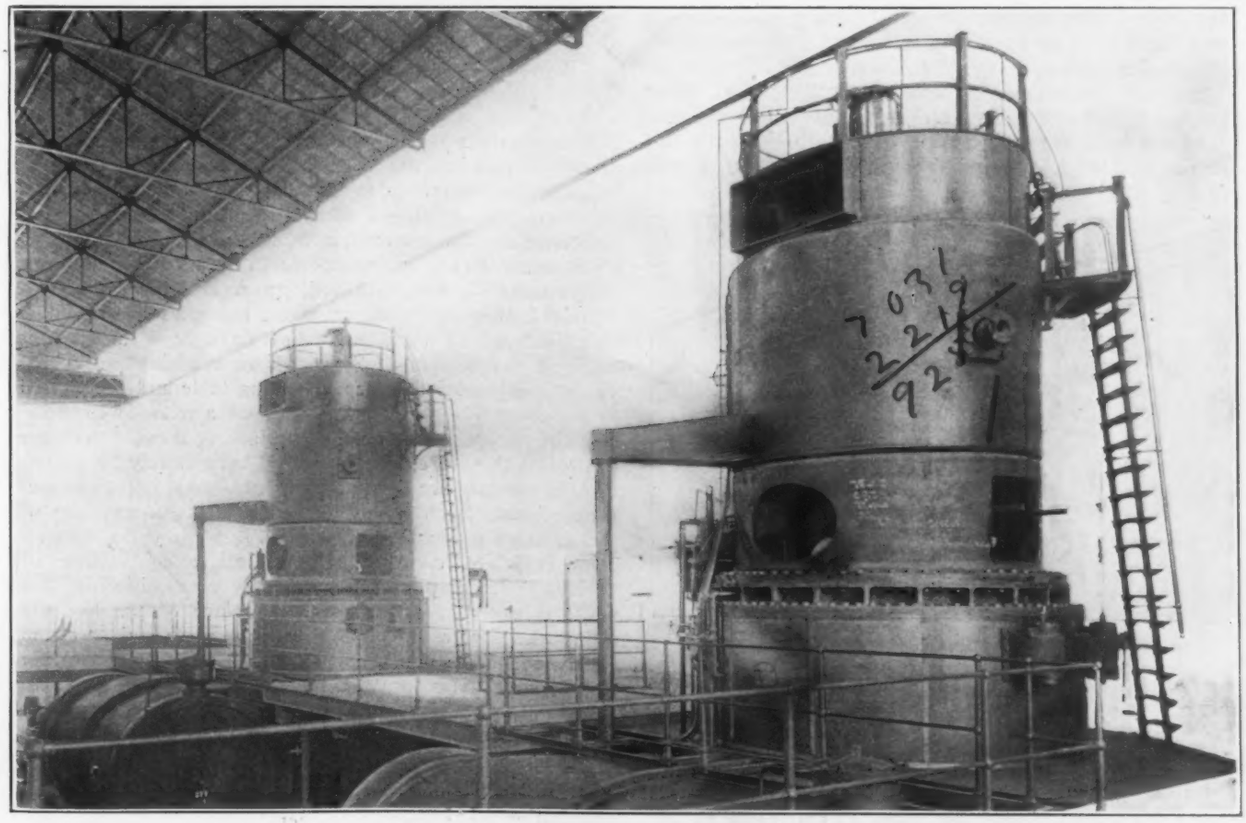


Fig. 1—Interior, Showing Vertical Turbo-Alternators.

story for feeding the coal chutes of the stokers. The coal bunkers are built of reinforced concrete and hold a total of about 300 tons of coal. The same conveyor handles the cinders as well, and for this purpose it runs down one side and comes under the boilers. The cinders fall from the grate upon a sloping chute under each furnace, and they are shoveled by hand into the conveyor buckets which pass

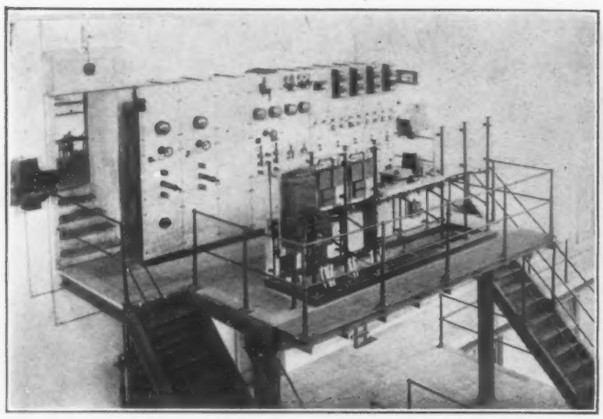


Fig. 3—Switchboard.

along at this point; then the conveyor drops the cinders into an outside hopper for loading onto wagons.

Each boiler has a grate area of 75 sq. ft. Under the floor is a line shafting which drives each of the automatic stokers by belt, as will be noticed. The shafting is usually driven by a three-phase, 15-hp motor, but should the supply of energy fail it can be coupled to a direct-current motor which receives energy from a storage battery, so that the stoking is always assured. For the water feed of the boilers use is made of the condensation water of the turbines, to which is added a water supply from the river, using a set of filtering tanks for this latter. An automatic float feed in the condenser-water tanks in the basement keeps these filled up by adding water from the river-water tanks in the yard.

Two separate methods of securing the boiler-feed water are used in this case. Two turbine pumps delivering 1400 cu. ft. per hour are each driven by a 35-hp electric motor running at 2400 r.p.m., and this gives the regular supply.

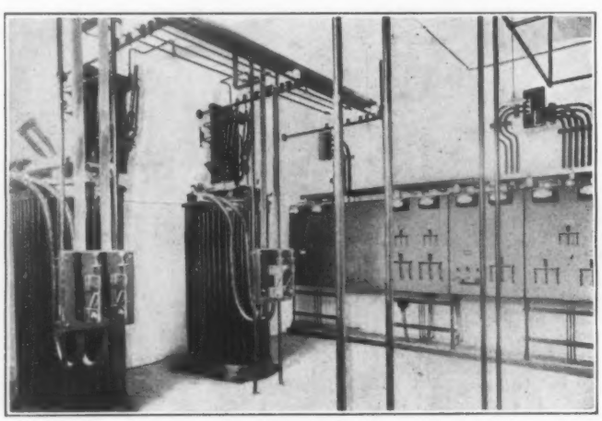


Fig. 4—Transformers.

As a standby, each boiler is provided with a steam injector so as to be self-feeding, and the water is taken from a common piping, which if need be can be fed directly from the river-water tanks. Rapid firing is provided for the boilers, because the units may need to be thrown on quickly in case of accident to the hydraulic plants. A forced draft is therefore provided in the two smoke flues by means of motor-driven air fans. The motors receive energy from the storage battery in this case.

Each of the 5000-hp Curtis steam turbine sets runs with steam superheated to 275 deg. C. and 180 lb. pressure, working at 880 r.p.m. Built with the turbines are three-phase alternators which deliver energy at 9000 volts. The condensers, which are in the basement, are of the tubular type,

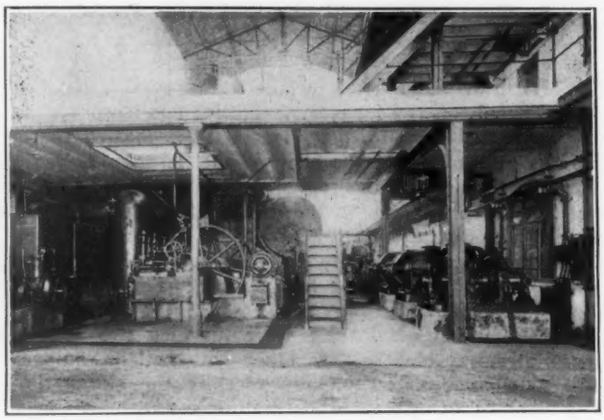


Fig. 5—Condensers in Basement.

and each is provided with a circulation water pump directly coupled to a 75-hp motor and with an air and condensed-steam pump of 36-in. diameter and 6-in. stroke, which is belted to a 35-hp motor. Each condenser takes care of 50,000 lb. of steam per hour. The steam-turbine groups, as well as the motors and other electrical apparatus, were designed and built at the Paris shops of the Thomson-Houston Electric Company.

STUDY OF THE LIGHT FROM THE MERCURY ARC.

Color of Light from the Mercury Arc with the Cooper Hewitt Fluorescent Reflector.

By Herbert E. Ives.

In a previous paper* the writer gave the results of color measurements of the Cooper Hewitt mercury-arc lamp with special reference to its relation to other illuminants which may be combined with it to produce approximately white light. These measurements were made with an Ives colorimeter and give the colors in terms of the mixing proportions of a certain red, green and blue light, the standard of comparison, or white, being an average daylight determined by a series of daylight measurements made at the Bureau of Standards in Washington. Those values are given in the accompanying table and are plotted in the color triangles, Fig. 1. In such a triangle combinations of two colors lie on the line joining them. "Average daylight," therefore, may be copied very closely by a mixture of mercury-arc light and tungsten-lamp light in proper proportions. Such a mixture constitutes an example of the additive production of white. But while the integral color is white, owing to the subjective equivalence of various different physical stimuli, the composition of this white is not that of daylight. In place of the uniform continuous spectrum of the latter is a compound spectrum consisting of the bright emission lines of the mercury arc and the continuous spectrum of the tungsten lamp (Fig. 2). Such a light, while white, is only indifferently good for color matching. Certain colors are present too strongly, others not enough. Green and yellow are apt in particular, because of the intense green line at 0.546 μ, to show distortions. One of the most interesting points brought out,

*Bulletin Bureau of Standards, VI, 2, page 265.

however, is that, while it is spectral red that is deficient in the mercury arc, mere addition of red light will not render it white. The integral color of the arc is bluish white, calling for a yellowish-white addition. The most general requirement is for a yellow-white which shall contain red. From the standpoint of spectral composition this is equivalent to a red-plus-green yellow, the red and green fitting

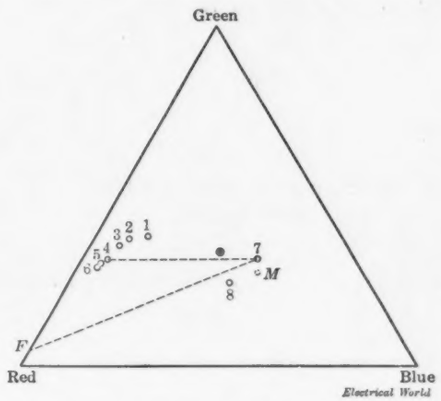


Fig. 1—Color Triangle Showing Color Values of Various Illuminants.

into the missing portions of the mercury spectrum and being of such relative intensity as to make together a yellowish white.

A very striking contribution to the problem of supplying the missing radiations of the mercury arc is the fluorescent reflector of Dr. Peter Cooper Hewitt. This consists of a layer of a fluorescent dye (rhodamine) in a suitable solvent, flowed on a white card, which is substituted for the usual white enameled reflector furnished with the Cooper Hewitt mercury arc. The fluorescent light from the reflector, excited by the green and blue mercury radiation, is red and therefore supplies a missing element.

Recently, through the kindness of Dr. Hewitt, the writer has had a sample of the fluorescent reflector for examination. This offered an opportunity to make color measurements with the same instrument and in the same units as those referred to in the previous paper. The results of the measurements are given under number 8 in the accompanying table, and the position of the light with reflector is plotted in the color triangle at 8, that of the reflector alone being approximately at *F*.

In entire agreement with the previous findings, it appears that this combination of bluish-white and red light does not make the average daylight here used as standard. Instead a less green—that is, a pinker light—is produced. In this connection it may not be out of place to remark that this is exactly the direction in which cloudy and smoky city daylight most consistently varies from the

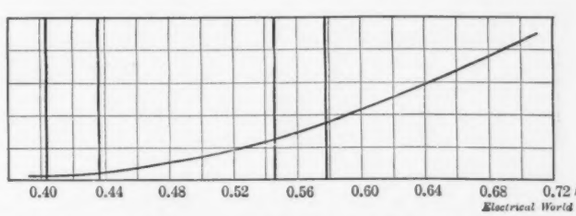


Fig. 2—Spectral Distribution, Mercury-Arc-Tungsten Combination.

average daylight of these measurements. As has been shown by the work of Nichols, the color of the sky is influenced to a noticeable degree by the reflected light of grass and foliage. The measurements made at the Bureau of Standards, with its silvan surroundings, might therefore be expected to record a greener average than would be obtained in a city such as Cleveland or Pittsburgh. It is this urban daylight that the Cooper Hewitt lamp and reflector most nearly approximate.

A point of interest in connection with color theory and measurement is brought out by the color triangle plot. It appears that the integral light 8 does not exactly lie on the line joining its two components. At first this would appear to be an error, but a little consideration shows this to be correct. For the reflector acts not only as a fluorescent light giver but as an absorber, and as its maximum of absorption lies in the green of the spectrum (dotted curve in Fig. 3) it reduces considerably the green element of the regularly reflected (non-fluorescent) light. Consequently the two components are not the fluorescent light and the ordinary mercury-arc light, but the fluorescent light and the modified, less green mercury light lying approximately at *M* in the color triangle.

COLORIMETER MEASUREMENTS OF ILLUMINANTS.

	Red.	Green.	Blue.
1. Welsbach, ½ of 1 per cent cerium	48.7	38.3	13.0
2. Welsbach, ¾ of 1 per cent cerium	54.0	37.4	8.6
3. Welsbach, 1¼ per cent cerium	57.5	35.5	7.0
4. Tungsten incandescent lamp, 1¼ watts per candle	61.4	31.7	6.9
5. Tantalum incandescent lamp, 2 watts per candle (similar in color to Gem 2.5 watts per candle)	64.6	30.4	5.0
6. Carbon incandescent lamp, 3.1 watts per candle	65.7	29.8	4.5
7. Cooper Hewitt mercury arc	24.1	31.4	44.5
8. Cooper Hewitt mercury arc with fluorescent reflector	34.8	24.5	40.7

Some spectrophotometer measurements are of interest. In Fig. 3 are spectrophotometric values, expressed in terms of energy intensity for the fluorescent light. The positions of the chief mercury-arc spectral lines are also shown. It is obvious that this light will be far from perfect as a color-matching light, owing to the absence of blue-green and the presence of the strong emission lines. This shows on such colors as greens and browns. Nevertheless, the improvement in the light brought about by the addition of red is enormous.

An interesting possibility is suggested by consideration of these and the colorimeter measurements. In order to produce an approximately continuous spectrum and at the same time an "average daylight," there is required some green light, approximately the spectral distribution (or maximum) shown in the dashed curve. This might be supplied by the fluorescence of another substance than rhodamine. It is not improbable that such a substance would have its region of excitation in the blue or violet, or even in the ultra-violet. In the latter case the reflector would increase, instead of decreasing the efficiency of the combination. By projecting a spectrum of the mercury arc upon the rhodamine reflector it is found that the chief exciter of fluorescence is the green line; in other words,

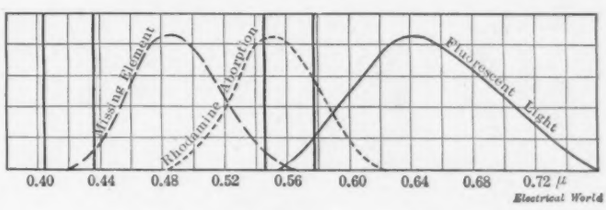


Fig. 3—Mercury Arc with Filament Reflector.

the fluorescent light is largely at the expense of the green light. If not only the red but also the green light suggested as advisable could be supplied at the cost of the strong ultra-violet which is now thrown away by absorption in the glass, a gain not only in color quality but in efficiency would result. Speculation is, however, easier than attainment.

AN INVESTIGATION OF TRANSMISSION-LINE PHENOMENA BY MEANS OF HYPERBOLIC FUNCTIONS.

The Distribution of Voltage and Current Over Π Artificial Lines in the Steady State.

By A. E. Kennelly.

ARTIFICIAL lines composed of uniform sections are divided into two classes, namely, T-lines and Π-lines.

A T-line, as shown in Figs. 1 and 2, consists of a simple series connection of similar and symmetrical T-sections; that is, sections all alike in having two equal line resistances, and a leak conductance connected to ground, or

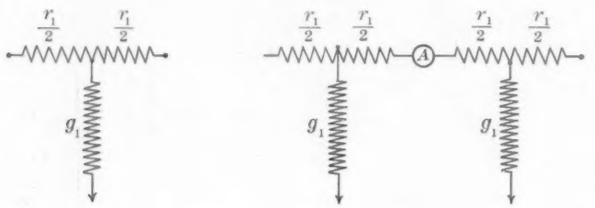


Fig. 1—Single T-Section and Pair of T-Sections Connected Through an Ammeter A.

zero potential, between them. A Π-line, as shown in Figs. 3 and 4, consists of a simple series connection of similar and symmetrical Π-sections; that is, sections all alike, having two equal leak conductances, and a line resistance connected between them.

It has been shown in previous publications[1] that any T-artificial line of uniform sections is externally replaceable by one and only one uniform smooth line; that is, a line of smoothly distributed electrical linear constants. It is proposed here to show how the equivalent smooth line of a Π-artificial line compares with that of a T-artificial line of similar series and shunt elements.

Figs. 5, 6 and 7 show a five-section T-line and its equivalent smooth line of uniformly distributed leakance, in three different conditions at the distant end; namely, free in Fig. 5, directly grounded in Fig. 6, and to ground through a terminal load of 750 ohms in Fig. 7. In each case an emf of 100 volts is impressed on the left-hand end of the line.

Figs. 8, 9 and 10 similarly show a five-section Π-line and its equivalent smooth line, under corresponding terminal conditions.

In every case the artificial line is made up of sections each having $r_1 = 500$ ohms of line resistance, and $g_1 = 0.00025$ mho leakage conductance or leakance; that is, 0.25 millimho leakance per section.

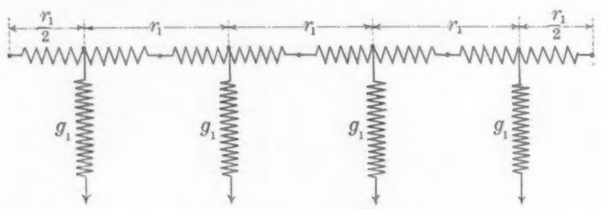


Fig. 2—Artificial Line of Four T-Sections.

Considering first the behavior of the T-lines of Figs. 5, 6 and 7, the first step is to find the apparent hyperbolic angle u which is subtended by a half-section of the line. That is:

$$u = \frac{\sqrt{g_1 r_1}}{2} \qquad \text{apparent}^2 \text{ hyps} \quad (1)$$

or in this case

$$u = \frac{\sqrt{0.00025 \times 500}}{2} = \frac{\sqrt{0.125}}{2} = 0.176777 \text{ apparent hyps}$$

But this has to be corrected for the lumpiness of the artificial line by applying the ratio $\frac{\sinh u}{u}$ to the left-hand side of (1), or

$$\sinh u = \frac{\sqrt{g_1 r_1}}{2} \qquad \text{numeric } \angle \quad (2)$$

in this case

$$= 0.176777$$

whence by inspection of hyperbolic tables

$$u = 0.175868 \qquad \text{hyps}$$

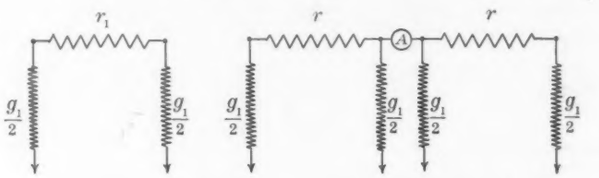


Fig. 3—Single Π-Section and Pair of Π-Sections Connected Through an Ammeter.

A single section of the line will subtend an angle of $2u$ hyps, and the five-section lines of Figs. 5, 6 and 7 an angle of $\theta = 10u$, or 1.75868 hyps. Consequently, the equivalent smooth line corresponding to one section of artificial line must likewise subtend an angle of $2u$, or 0.351736 hyp, and that corresponding to five sections must subtend $\theta = 10u$, or 1.75868 hyps, as indicated in Figs. 5 and 6.

The next step is to find the apparent surge resistance z_0' of the T-lines in Figs. 5, 6 and 7. This is

$$z_0' = \sqrt{\frac{r_1}{g_1}} \qquad \text{apparent ohms} \quad (3)$$

or in this case

$$= \sqrt{500/0.00025} = 1414.2 \qquad \text{apparent ohms}$$

Lumpiness in the T-line is corrected for by applying the factor cosh u, and the corrected surge-resistance z_0 of the equivalent smooth line is:

$$z_0 = z_0' \cosh u = \cosh u \sqrt{\frac{r_1}{g_1}} \qquad \text{ohms} \quad (4)$$

In this case, cosh $0.175868 = 1.0155$, and $z_0 = 1414.2 \times 1.0155 = 1436.1$ ohms. The smooth line equivalent to five sections of T-line would therefore contain in its conductor a total resistance of

$$R = \theta z_0 = 10u \cdot z_0 \qquad \text{ohms} \quad (5)$$

where θ is the total hyperbolic angle of the line. In this case, $R = 1.75868 \times 1436.1 = 2525.7$ ohms, as compared

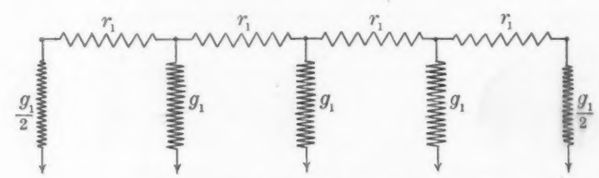


Fig. 4—Artificial Line of Four Π-Sections.

with 2500 ohms in the T-line. The total smooth line leakance would also be

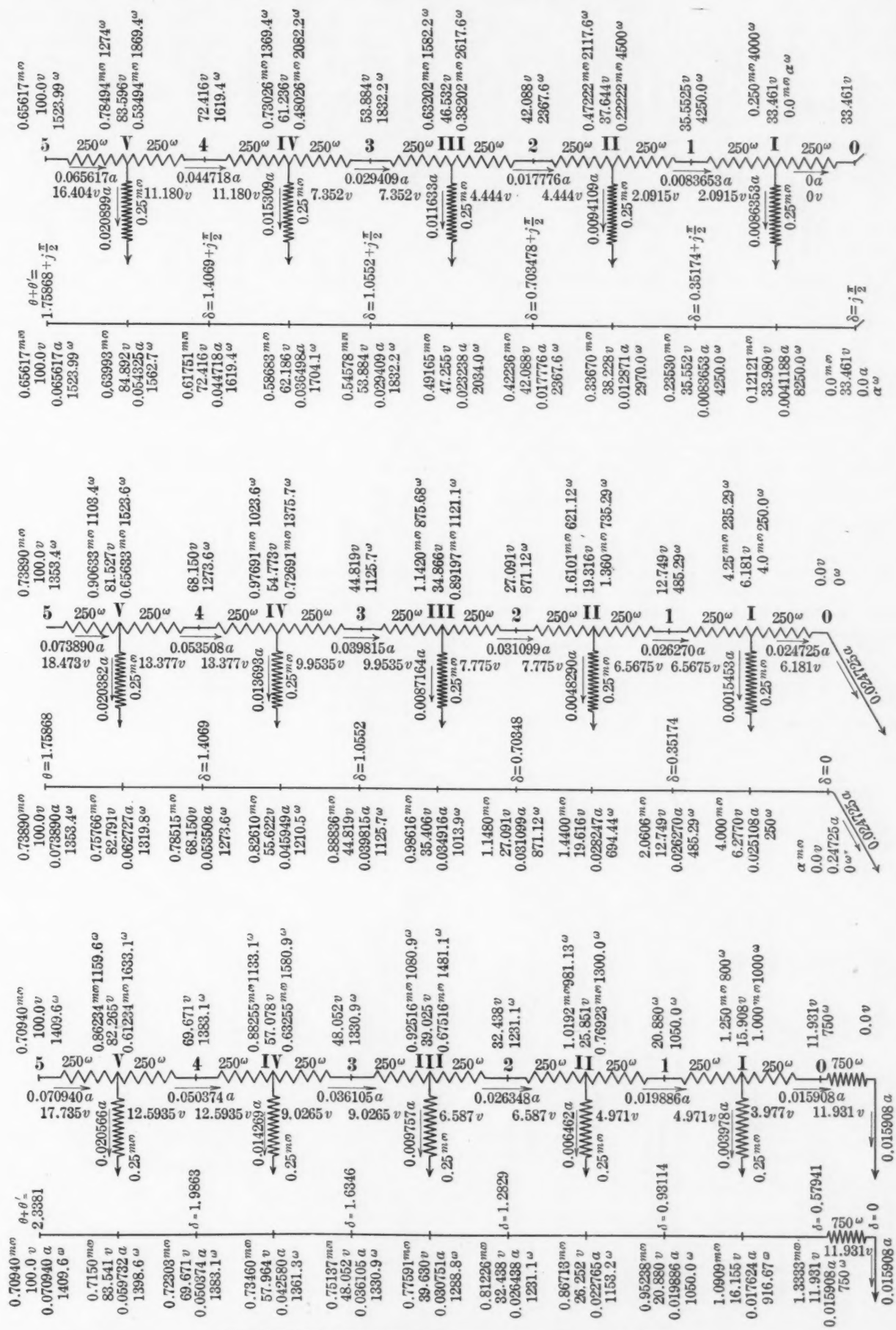
$$G = \theta / z_0 = 10u / z_0 \qquad \text{mhos} \quad (6)$$

or in this case $1.75868/1436.1 = 0.0012246$ mho, as compared with a total of 0.00125 mho in the T-line.

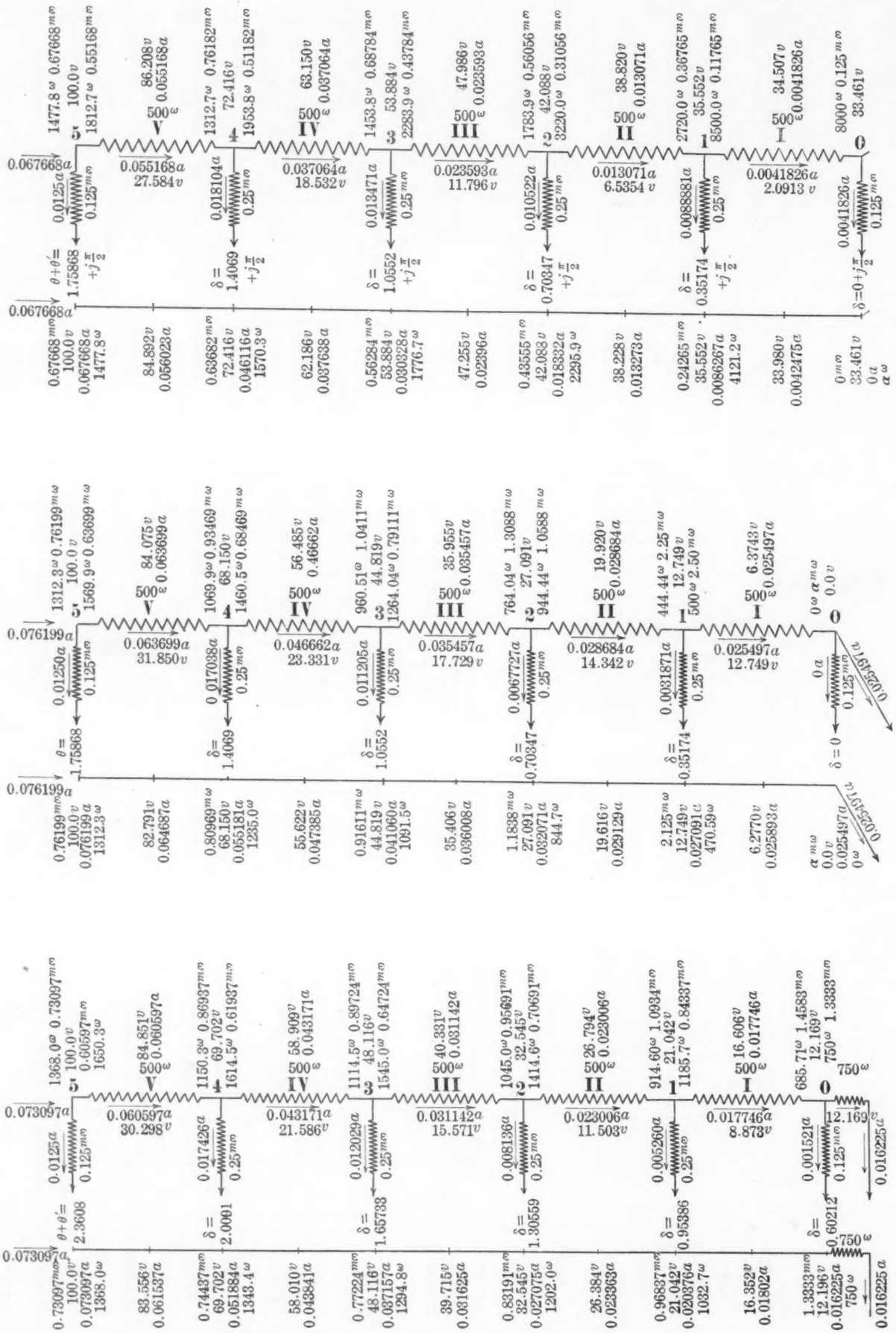
In Fig. 5 the line angle δ is assigned to the junction points

[1] "Artificial Lines for Continuous Currents in the Steady State," by A. E. Kennelly, *Proc. Am. Ac. of Arts & Sc.*, Vol. XLIV, No. 4, pp. 97-130, Aug. 26, 1908; also "The Application of Hyperbolic Functions to Electrical Engineering Problems," by A. E. Kennelly, University of London Press, 1912. Appendix F.

[2] The term "hyp" is used as a contracted form for "hyperbolic radium."



Figs. 5, 6 and 7—Diagrammatic Representation of T-Line Constants.



Figs. 8, 9 and 10—Diagrammatic Representation of Π-Line Constants.

of the T-sections on the artificial line, and also to the corresponding points along the equivalent smooth line. As in Figs. 5 to 10, the distribution of resistance, conductance, voltage and current has been derived by direct Ohm's-law computation; while the corresponding distribution along the equivalent smooth line has been derived by hyperbolic functions in the regular way. If a smooth line is grounded directly at its distant end, the angle θ' of that end is zero, and those at junctions 1, 2, 3, 4 and 5 are

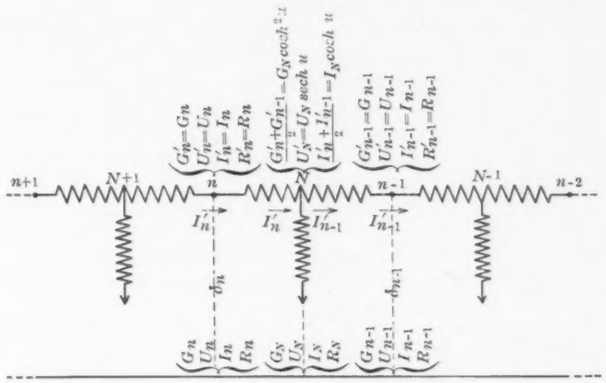


Fig. 11—Comparative Relations of Potential, Current, Conductance and Resistance Along a T Artificial Line and Along Its Equivalent Smooth Line.

respectively $2u$, $4u$, $6u$, $8u$ and $10u$. If the distant end is put to ground through a resistance σ ohms, the angle of that end is

$$\theta' = \tanh^{-1}\left(\frac{\sigma}{z_o}\right) \qquad \text{hyps} \quad (7)$$

In this case, with $\sigma = 750$, and $z_o = 1436.1$,

$$\theta = \tanh^{-1} 0.522233, \text{ or } \theta = 0.57941.$$

The angle δ assigned at successive junctions is then $2u + \delta$, $4u + \delta$, $6u + \delta$, etc., as indicated in Fig. 7. We then have along the smooth line, for any point P whose angle is δ,

$$U_P = U_A \frac{\sinh \delta}{\sinh (\theta + \theta')} \qquad \text{volts} \quad (8)$$

$$I_P = I_A \frac{\cosh \delta}{\cosh (\theta + \theta')} \qquad \text{amperes} \quad (9)$$

$$R_P = R_A \frac{\tanh \delta}{\tanh (\theta + \theta')} \qquad \text{ohms} \quad (10)$$

$$G_P = G_A \frac{\coth \delta}{\coth (\theta + \theta')} \qquad \text{mhos} \quad (11)$$

where $(\theta + \theta')$ is the angle of the whole line including the terminal addition, or $\theta + \theta' = 10u + \theta' = 2.3381$ hyps in the case of Fig. 7. U_A, I_A, R_A, G_A are respectively the potential, current, resistance and conductance of the smooth line, as measured at the home end, or left-hand end in the figures.

If the line is freed at the distant end, as in Fig. 5, then

$$\sigma = \infty, \text{ and } \theta' = \tanh^{-1}\left(\frac{\infty}{z_o}\right) = j\frac{\pi}{2} \qquad \text{hyps} \quad (12)$$

where $j = \sqrt{-1}$; so that each of the angles δ indicated in Fig. 6 becomes increased by $j\frac{\pi}{2}$ in Fig. 5. This has the effect of interchanging the functions as follow:

$$\sinh\left(\delta + j\frac{\pi}{2}\right) = j \coth \delta \qquad \text{numeric} \angle \quad (13)$$

$$\cosh\left(\delta + j\frac{\pi}{2}\right) = j \sinh \delta \qquad " \quad (14)$$

$$\tanh\left(\delta + j\frac{\pi}{2}\right) = \coth \delta \qquad " \quad (15)$$

$$\coth\left(\delta + j\frac{\pi}{2}\right) = \tanh \delta \qquad " \quad (16)$$

With this understanding formulas (8) to (11) apply to all smooth lines, whether the distant end be grounded, freed, or in any intermediate state.

Comparing the smooth and T-line distributions in Fig. 6, it will be seen that at each junction between successive T-sections the potential, current, resistance and conductance are all identical with the corresponding values on the smooth line. Thus at junction 3, the line-angle δ being 1.0552 hyps, the potential is 44.819 volts, the current passing over the junction is 0.039815 amp, the resistance at and beyond the junction is 1125.7 ohms, and the conductance is the reciprocal of this, or 0.88836 millimho, all measured to ground return circuit. At the point on the equivalent smooth line, where the line angle is 1.0552 hyps, the same values present themselves. It will be understood that on the smooth line the potential is directly proportional to the sine, the current to the cosine, the resistance to the tangent, and the conductance to the cotangent of the hyperbolic line angle δ.

Between junctions on the T-line, the potential and the resistance fall off according to a straight-line law, or Ohm's law. The current remains constant down to the midsection and then falls off abruptly by the amount of current escaping at the leak. Along the smooth line, between corresponding points, the change in values remains smooth and continuous, according to the hyperbolic function laws represented in formulas (8) to (11).

Similarly considering Fig. 7, the same conditions are found. The junction line-angles have all been increased by 0.57941 hyp, the angle subtended by the terminal load of 750 ohms. At section-junctions the electrical values on the T-line are identical with those at the corresponding points on the smooth line. It may be considered that the T-line possesses line-angles at the junctions, and there only, so that there are only six points, along the terminally loaded T-line, which possess line-angles. The smooth line has a line-angle corresponding to each and every point along its length; or may be said to possess an indefinitely great number of line-angle points. Under these limitations, the electrical distributions are identical on the T-line and on the smooth line at all the T-line points to which a line-angle can be assigned.

Again taking the case of Fig. 5, with the line freed, the

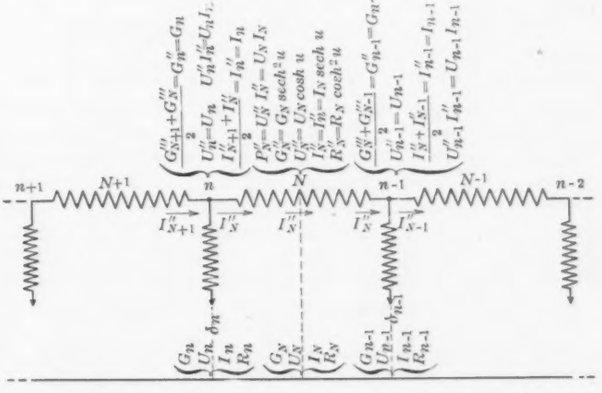


Fig. 12—Comparative Relations of Potential, Current, Conductance and Resistance Along a Π Artificial Line and Along Its Equivalent Smooth Line.

angle subtended by the terminal load of infinite resistance is $j\frac{\pi}{2}$ hyps, and the agreement with formulas (8) to (11) at section-junctions repeats itself.

The conditions for any T-line, as exemplified in Figs. 5, 6 and 7, are summarized in Fig. 11, which shows that at any junction, such as junction n, the electrical values are identical with those at the corresponding point on the equivalent smooth line. At any midsection, such as midsection N,

the potential is found by applying the factor sech u to the potential at the corresponding smooth-line point; so that

$$U'_N = U_N \operatorname{sech} u = U_N/\cosh u \quad \text{volts} \quad (17)$$

The arithmetical mean of the two currents at the midsection, one on each side of the leak, is also found by applying the factor cosh u to the current at the corresponding smooth-line point. It is evident that since the conductance at any point is the ratio of current to voltage thereat, the mean conductance at a midsection will be $\cosh^2 u$ times the corresponding smooth-line point conductance.

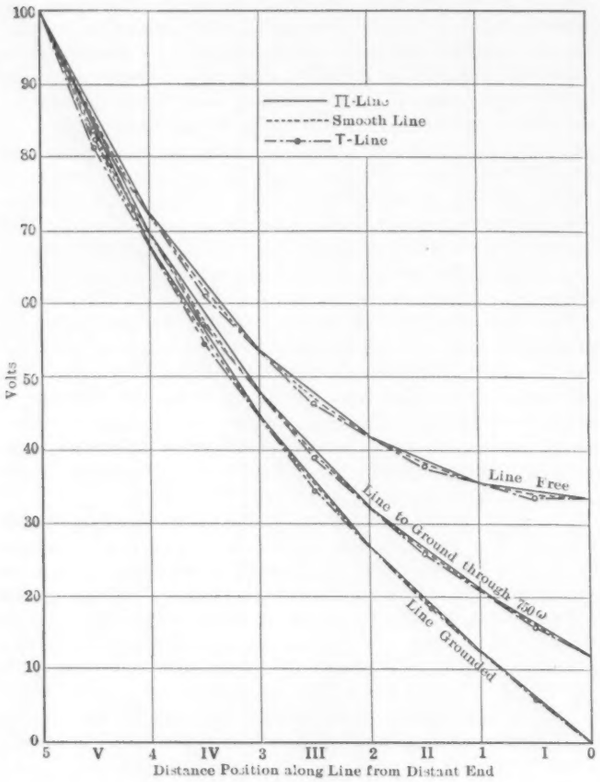


Fig. 13—Fall of Potential.

Turning now to the behavior of Π-lines as represented in Figs. 8 to 10, the first step is to find the angle u subtended by a half section. The apparent half-section angle is found by formula (1), which means that the semi-section angle u of a Π-line is the same as that of a T-line having the same values of r_1 and g_1 in any section. In a single T-section, taken separately as in Fig. 1, the line element is in two equal portions $r_1/2$, and the leak g_1 is single; whereas in a single Π-section, taken separately as in Fig. 3, the leak is in two equal portions $g_1/2$, and the line element r_1 is single. When a number of T-elements or Π-elements are associated to form a line, as in Figs. 2 and 4, the half-elements merge into full values r_1 and g_1, except at the ends of the line. Formula (2) thus applies to both T-lines and Π-lines, which means that the angle subtended by an artificial line of a given number of uniform sections is the same, whether a T-line or Π-line is used.

The apparent surge-resistance z_0'' of the Π-line is likewise determined, as in the case of a T-line, by formula (3), but the lumpiness correcting factor is the reciprocal of that used with a T-line; so that the corrected surge-resistance z_0 of a Π-line is

$$z_0 = z_0'' \operatorname{sech} u = \operatorname{sech} u \sqrt{\frac{r_1}{g_1}} \quad \text{ohms} \quad (18)$$

In the case represented by Figs. 8, 9 and 10, the surge resistance of the Π-line, and also of its equivalent smooth line, is $z_0 = 1414.2/1.0155 = 1392.6$ ohms. The total resistance in the smooth line of Figs. 8 to 10 is therefore 2449 ohms, and the total leakance 1.263 millimhos, by (5) and (6).

Referring to Fig. 9, it will be seen that the line angles and their potentials of the Π-line correspond identically to those of the T-line; but the currents, resistances and conductances differ slightly from those of the T-line. This difference is due to the difference in surge resistance.

Comparing the Π-line with the T-line diagrams, it is evident that the potentials at section-junctions correspond identically with those on the smooth line. Owing, however, to the merging of the adjacent leaks of successive Πs, the current at a section-junction is not the same as on the smooth line. The arithmetical mean current is, however, the same, and if the two components $g_1/2$ of each leak were separated, and the ammeter introduced between them as at A in Fig. 3, the current so indicated would be the same as on the equivalent smooth line .

The results of the analysis of a Π-line are indicated in Fig. 12. At any midsection, say N, the voltage is cosh u times that at the corresponding smooth-line point; the current is, on the contrary, less in the same ratio. That is,

$$U''_N = U_N \cosh u \quad \text{volts} \quad (19)$$
$$I''_N = I_N \operatorname{sech} u \quad \text{amperes} \quad (20)$$
$$R''_N = R_N \cosh^2 u \quad \text{ohms} \quad (21)$$
$$G''_N = G_N \operatorname{sech}^2 u \quad \text{mhos} \quad (22)$$
$$P''_N = U''_N I''_N = U_N I_N = P_N \quad \text{watts} \quad (23)$$

In practice, when making measurements at a Π-line junction, the current in the line is measured on one or the other side of the junction. It is, therefore, the same as the current at the midsection on that side, and its value can be predetermined by reference to (20); that is, to the current at the corresponding midsection of the equivalent smooth line.

The results of the whole analysis may also be summed up in the proposition that both on Π-lines and on T-lines the power, $P = UI$ watts, is the same as at the corresponding point of the equivalent smooth line, not only at section-junctions, but also at midsections, provided the line current I at any leak be defined as the arithmetical mean of the line currents on each side of it.

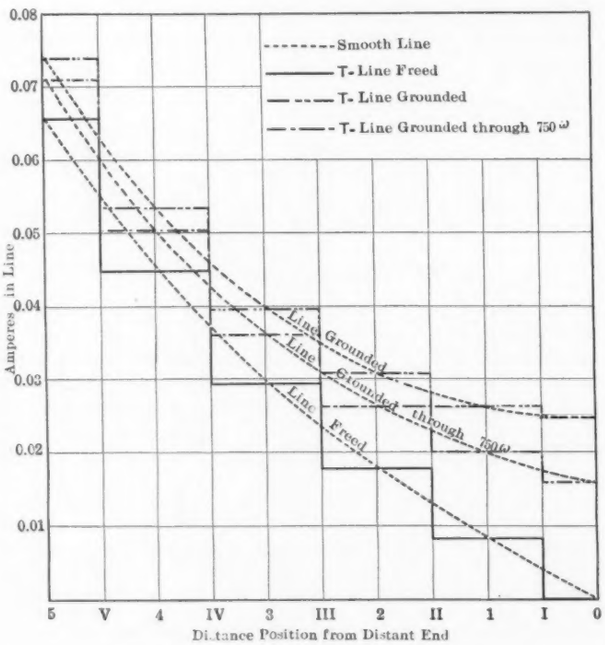


Fig. 14—Current Strengths Along T-Line.

Fig. 13 shows the fall of potential along the T-lines, Π-lines and smooth lines for the cases here considered. With the line free, the smooth-line curve is a pure cate-

nary. The Π-line voltages form a weighted string polygon, internal to the catenary, coinciding at junction points. The T-line voltages form a weighted string polygon external to the catenary, also coinciding at the junction points. The electrical propositions here considered in relation to artificial lines have important bearings by analogy in mechanics,

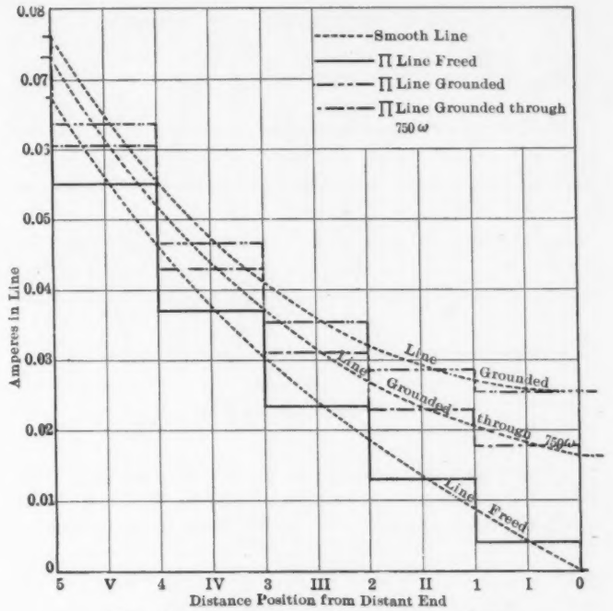


Fig. 15—Current Strengths Along Π-Line.

with respect to the catenary and the contacting weighted string polygons of the same.

Figs. 14 and 15 give the corresponding curves of current fall along the lines. In the T-line, the currents coincide with the smooth-line values at junctions. In the Π-line, only the mean currents coincide in this manner.

All of the cases thus far considered have been continuous-current cases, involving only resistance and leakance. But all of the formulas arrived at apply equally well to any single-frequency alternating-current case when interpreted vectorially. The line-angles, potentials, currents, resistances and conductances will then all be vector quantities. The algebraical treatment is, however, exactly the same as that already discussed.

In all of the cases considered, the emf has been assumed to be impressed at the left-hand end only. If, however, emf be applied to both ends of the artificial line simultaneously, the terminal effects will be the same as when these emfs are similarly applied to the two ends of the equivalent smooth line.

DOUBLING THE LIFTING CAPACITY OF MAGNET BY VERTICAL STACKING OF PIG IRON.

Heretofore the practice of handling furnace pig iron with electromagnets has been limited by the quantity that could be lifted under the ordinary plan of picking the iron from the ground or floor. With the pigs lying flat, only a relatively small number adhere to the magnet. At the Zenith furnace in Minnesota experiments have recently been made with stacking the pigs vertically, standing each pig erect on end. This arrangement allows a greater number of pieces to make direct contact with the magnet pole-pieces, and the lifting capacity of the magnet is correspondingly increased. In fact, with a given magnet which was able to pick up only 1000 lb. of pigs lying flat, 2000 lb. can be lifted if the pigs are stacked vertically on the floor. This doubling of the lifting capacity of the magnet is attained with but little added expense for labor in stacking the pigs.

THE PROPAGATION OF ELECTRIC ENERGY BY STANDING AND TRAVELING WAVES.

Experimental Test of an Artificial Transmission Line.

BY JOHN F. H. DOUGLAS.

AS the lengths of transmission lines increase several effects become more and more noticeable; first the charging current becomes larger, then the regulation becomes worse, and finally the receiver voltage at no load becomes considerably larger than the generator voltage.

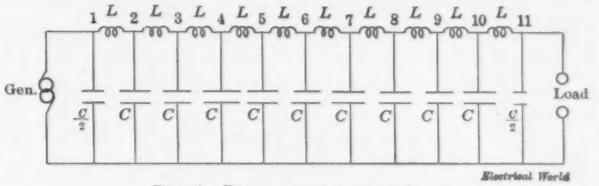


Fig. 1—Diagram of Connections.

The tests described in this article will show that in each of the respects mentioned it is possible to overcome these effects almost entirely. The writer believes that the article contains the first published account of the possibility of having a better regulation on alternating than on direct current. Tests were made on three artificial lines, all of which were constructed of laboratory choke coils and paper condensers. The arrangement shown in Fig. 1 was used in all cases.

The first line had an aggregate capacity of 321 microfarads, an inductance of 0.173 henry, and effective alternating-current resistance of 4 ohms. This corresponds to one phase of an actual combination of sixteen three-phase lines in parallel, each 1345 miles in length and consisting of 1,200,000-circ. mil conductors spaced 23 ft. apart. Or else it represents sixteen lines each 428 miles long consisting of 400,000-circ. mil conductors spaced 13.5 ft. with 1917 miles of artificial loading concentrated in a substation.

The second line differed from the first only in that the connections of the choke cells were changed so as to double the number of turns in series. Thus the new inductance was four times the old. This line corresponds therefore to eight actual lines in parallel such as were described in the previous paragraph, the length being in this case 2690 miles. The third line had a greater inductance, corresponding to a line 3200 miles long.

The reason for taking the performance on an aggregate

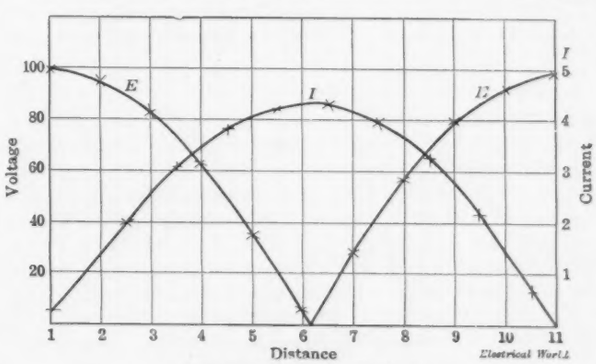


Fig. 2—Open-Circuit Test.
l=1345, N=1, λ = 2690, f = 68.

of lines was to secure a practicable current reading at 110 volts, which was the largest amount available.

Most of the data secured are shown in the plats; however, some are given in a table. The following abbreviations are used: l = the length of the line in miles, f is the frequency, N is the number of segments, λ is the wave length. The numerical subscripts indicate the station along

the line at which the reading was taken; thus E_1 means the generator voltage and I_s means the current in the section on the generator side of station 3. E_l and I_l refer to the load voltage and current.

The test results as plotted in Figs. 2 to 6 show clearly by the presence of nodes and loops that in such transmission lines there exist the phenomena of standing waves. In

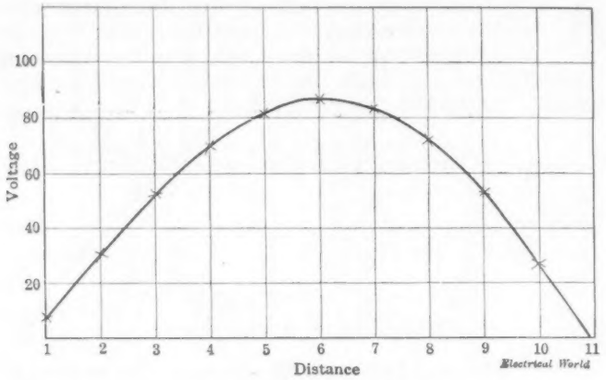


Fig. 3—Short-Circuit Test.
$l = 1345$, $N = 1$, $\lambda = 2690$, $f = 68$, $I_l = 3.88$.

other words, the distribution of voltage is very much like that of the motion of a vibrating elastic cord. Moreover, by referring to Fig. 2 it is seen that where there is a node of potential the current is a maximum, and vice versa. Hence, although not read and recorded in the other no-load runs, the current follows the potential wave with a phase difference of 90 deg. Thus in Fig. 3 the current is very small at the center of the line because the voltage is a maximum there. The interval betwen two consecutive nodes is called a segment. The length of a wave is the length of two segments. Thus, Figs. 1 and 2 refer to a half-wave line. The frequency of a wave varies inversely as the wave length, the velocity of propagation being the same, and a short calculation would show that this is only a few per cent less than that of light.[1]

Referring again to Figs. 2 and 3, it will be observed that the voltage at the center of the half-wave line seems to depend only on the load current, and the current at the center of the line seems to depend only upon the load voltage. This indicates that at the quarter-wave points the characteristic of the line has been changed from constant potential to constant current. This fact is already well known.[2]

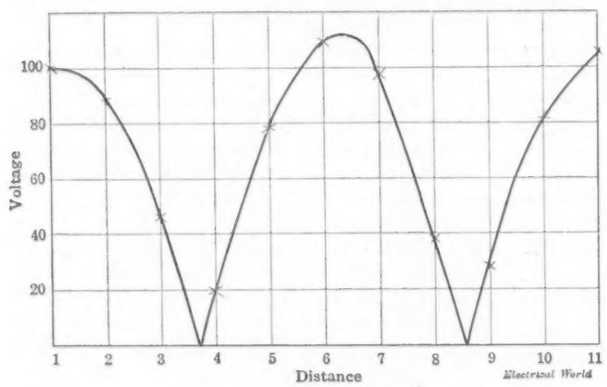


Fig. 4—Open-Circuit Test.
$l = 2690$, $N = 2$, $\lambda = 2690$, $f = 68.8$.

With reference to a line one-half wave in length, it will be noted that the charging current is very small, being merely enough to supply the losses. The impedance drop is also very small, simply enough to supply the line losses.

Perhaps the most interesting results are those plotted in Figs. 7 and 8, showing that the regulation of a half-wave line is better on inductive load than non-inductive load. Such a line regulates better on alternating than on direct current, as is shown in the accompanying table by the fact that the regulation is only one-half of the IR drop.

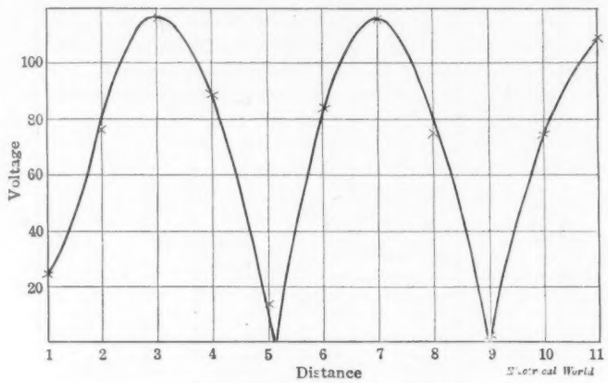


Fig. 5—Open-Circuit Test.
$l = 2690$, $N = 2\frac{1}{2}$, $\lambda = 2150$, $f = 84.5$ (estimated).

Figure 8 perhaps needs some further explanation. The sides of the polygon of voltages shown there are the voltages ΔE, which are measured as the drops in the successive

TABLE I.—REGULATION TESTS ON A HALF-WAVE ARTIFICIAL TRANSMISSION LINE.

Frequency.	E_1.	I_l	Power-Factor, per Cent.	E_l	Regulation, per Cent.	IR, per Cent.
68	110	0	.....	109.0	.....	.....
68	110	4.72	100	98.9	10.2	19.0
68	100	0	.....	99.0	.....	.....
68	100	4.70	10	96.2	2.9	19.6

choke coils. At first sight one does not recognize this setting as indicating a traveling wave. However, such is the case. First it will be observed that there are no nodes. Then the voltage at each point, although nearly the same as

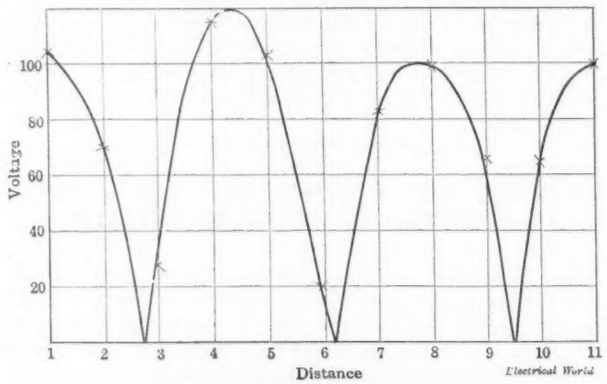


Fig. 6—Open-Circuit Test.
$l = 3200$, $N = 3$, $\lambda = 2130$, $f = 85$.

that at the preceding point in magnitude, reaches that maximum at a little later time. Thus the wave of voltage travels along the line and eventually reaches the load end.

From the physical point of view it may be said that the energy delivered to the load end of a half-wave line is transferred by virtue of a traveling wave. If all of the energy contained in a wave is not absorbed in the load, it

[1] Similar curves are shown in Dr. W. S. Franklin's "Electric Waves." A very clear description of the theory is there given also.

[2] Dr. C. P. Steinmetz, "Transient Phenomena," Sect. III, Chap. II, Art. 20, page 308.

must be reflected back toward the generator, thus resulting in a net transfer of zero energy, and a standing wave. In order for this standing wave to be consistent with good regulation the generator must be located near a loop of potential, or, in other words, at some half-wave multiple from the receiver of energy. This phenomenon of reflection will be seen therefore to be a necessary accompaniment to an efficient transmission of energy at partial loads. In this respect the problem is entirely different from that in telephone circuits.

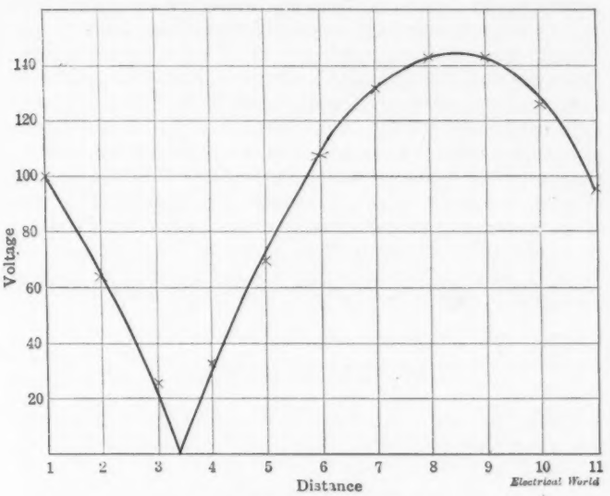


Fig. 7—Inductive Load Run.
$l = 1345$, $f = 68$, $I_1 = 4.70$.

To sum up, therefore, one may say that under normal load conditions the energy of the load is transmitted by means of a traveling wave, and the "ready-to-serve" condition at no load consists in a standing wave.

It is almost needless to state that in all respects the results as stated above are borne out by the mathematical theory developed by Dr. Kennelly. In fact, the tests were made to disprove or verify the conclusions already obtained by that means.[3]

The following explanation, however, must suffice here. When the half-wave line is stated to be essentially a constant-current line at its middle point, one may remember the "T-connected" resonating circuit described by Dr. Steinmetz in his "Alternating-Current Phenomena," here shown at the left of Fig. 9. This device actually converts, by resonance, constant impressed potential to a constant delivered current. Two such devices in series as shown would again give power at constant potential. The general similarity between this arrangement and the actual transmission line must be apparent. The fact that the voltage at one end of the line is exactly opposed to that at the other enables the line to supply its own charging current. That is, the charging current consists merely in an exchange of current between one end of the line and the other.

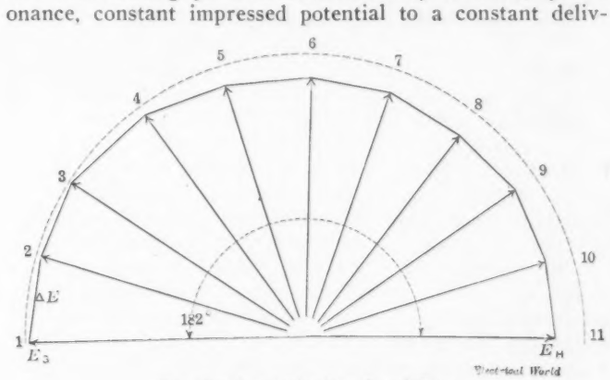


Fig. 8—Non-Inductive Load Run.
$l = 1345$, $f = 68$, $I_1 = 4.72$.

The fact that the regulation of a half-wave line is only about one-half of that of the same line on direct current is also readily explained. When it is remembered that one-half of the line has a constant current in it, it will be appreciated that half of the IR drop is constant. Only half the line has a current which varies with the load, causing a drop which affects the regulation.

The characteristics of small charging current and small regulation are so good in a line one-half wave in length that we are naturally interested in some of the commercial aspects of such a line. One feature that is disadvantageous in this kind of a line is that an open circuit at the center of the line would result in a very high voltage by resonance, at the broken end. If not relieved by corona, this action will destroy the insulation. One good point about such a line is that it would tend to relieve itself on any short-circuit. Under such conditions the voltage builds up to a very high value in the central portion of the line. If the building up is prevented by allowing corona to form the short circuit will be relieved to a large extent.

TABLE II—THE LENGTH OF A HALF-WAVE TRANSMISSION LINE FOR VARIOUS FREQUENCIES.

Frequency, cycles per second	25	60	125	212	500
Length, miles.....	3620	1520	730	428	182

The last point about such lines that can be taken up here is the fact that artificial loading of a presumably expensive kind would be necessary. For a velocity of propagation of 182,500 miles a second the lengths of unloaded half-wave transmission lines are as shown in the accompanying table. It will be seen that all of the combinations are improbable. Thus artificial loading would have to be used to make up the required length. For an equal utilization of the insulation of a line the normal voltage and current would be related by the following equation:

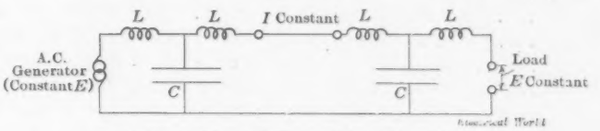


Fig. 9—Two T-Resonating Circuits.
$2\pi fL = \frac{1}{2}\pi fC$.

$$\frac{E}{I} = \sqrt{\frac{L}{C}}$$

It will be seen from this equation that loading inserted in the form of inductance would probably result in a voltage too high to be practicable. It would seem, therefore, that some form of condenser loading would have to be employed. This would most probably have to be located in some substation and used in conjunction with inductive loading as well. Owing to the fluctuating voltages in the system here described, the ordinary form of synchronous condenser could not be utilized.

Whether any of the remaining forms of condenser are suitable is a question that can hardly be answered at present. The object of this paper is merely to describe the phenomena, which it is believed are not well known, without intending to express an opinion whether it would be possible to build such a line or not.

The writer wishes to acknowledge the great assistance rendered by Messrs. F. K. Atkinson and H. R. Rosebro, students in the senior class in electrical engineering at Cornell University, in assembling and testing the line.

[3] Since the above was written, Dr. A. E. Kennelly and Mr. F. W. Lieberknecht have described tests made on a 646-mile transmission line in an A. I. E. E. paper (June, 1912). The absence of nodes and loops in their tests is attributable to two causes. The line they tested was a high-resistance, low-efficiency one in which nodes and loops are not well defined. Moreover, the equivalent length is reduced by the resistance to about one-sixth of a wave, which is too short to show nodes and loops.

Central Station
Management, Policies and Commercial Methods

CENTRAL-STATION SERVICE ON SHIPS.

The New York Edison Company has recently entered into a contract with the United Fruit Company to supply energy to the steamers of this line while at their docks in New York. The energy will be used for lighting and for operating cargo winches. The introduction of the central service will reduce the amount of steam equipment kept in operation heretofore when the ships were in port.

SPECIAL RATES FOR HYDROELECTRIC SERVICE.

The Milwaukee Electric Railway & Light Company has very lately placed in effect a new schedule of rates for electrical energy supplied exclusively from hydroelectric sources, under terms somewhat unusual and interesting. Energy will be delivered at a rate of not less than 200 kw, without any guarantee of continuity of service, and subject to the vicissitudes of hydroelectric generation, long-distance transmission and transformation. Only customers whose load consists of motors and miscellaneous lighting will be permitted to contract for this form of service. Electrical energy will be delivered at a pressure of approximately 13,200 volts, three-phase alternating current, at a frequency of 25 cycles; or in place of the delivery voltage stated above the pressure may be any other transmission voltage. The customer will be required to furnish the transformers, switching apparatus and lightning protection, of a type or types to be approved by the company. The latter states that this service should be taken only by customers having their own steam plants to serve as emergency reserve, and, furthermore, the service is offered only where delivery can now readily be made and the company does not obligate itself to extend its underground transmission system to make delivery.

The form of rate schedule consists of a demand charge plus an energy charge, with a minimum bill and discount for prompt payment. The demand charge will be $20 per kw per year for the first 200 kw and $15 per kw per year for all demand in excess of 200 kw, payable in equal monthly instalments. The energy charge will be 7 mills per kw-hr. for all energy consumed during each month; the minimum annual demand charge will be $4,000. On bills paid within ten days a discount of 5 per cent will be allowed on the first $25 of all bills, and 1 per cent on amounts in excess thereof. The company limits the amount of hydroelectric power to be sold to 10,000 kw. A customer's demand will be determined as the maximum rate at which energy is used for any period of fifteen consecutive minutes, and may be ascertained at the option of the company by counting the revolutions of the watt-hour-meter disk, or by printing the watt-hour-meter readings at quarter-hour intervals, or by the curve drawn by a recording wattmeter. The maximum demand charge during any month will be not less than that computed from the basis of 75 per cent of the maximum charge during any previous month of the contract period. Consumers will not be permitted to sell or otherwise dispose of any of the energy to any individual or corporation without the consent of the company. The measuring instruments or apparatus for determining the customer's demand and consumption will be supplied by the company and will be connected on the primary side of the customer's transformers or other equipment.

If the company's measuring instruments should fail at any time to register the energy used, the amount for the month during which a stoppage may occur shall be computed at the same average rate as for the two months next preceding, or, if energy has not been supplied during the two preceding months at a normal rate, then the next succeeding period of two months shall be used as a basis. Proper allowance shall also be made in case energy has not been used regularly during the months in which the stoppage occurred. Provision is included in the standard form of contract whereby the company may suspend the delivery of energy on Sundays and legal holidays for the purpose of making repairs, changes or improvements upon any part of its generating or distributing system, provided, however, that reasonable notice shall be given to the consumer. In the case of shut-downs of the last-mentioned character no reduction of the demand charge will be permitted.

OFF-PEAK SCHEDULE.

Under the title "Rates for Battery Charging, Refrigeration and Other Similar Service," the Commonwealth Edison Company of Chicago has issued schedules showing in the form of a comprehensive table the net costs per kilowatt-hour for various maxima, and various daily hours' use of maxima, for electricity during the off-peak period. These rates apply where the customer guarantees that his maximum demand shall not be less than 50 kw and further agrees not to require electrical energy from the company between the hours of 4 p. m. and 8 p. m. during the period beginning Oct. 1 and ending April 1. This period is referred to as the "peak period." Under these conditions the primary charge for the use of low-tension alternating current is $16.80 per kw per year for the first 50 kw and $9 per kw per year for demand in excess of 50 kw. The secondary charges on this schedule are as follows: First 2000 kw-hr. per month, 5 cents per kw-hr.; next 3000 kw-hr., 3 cents; next 25,000 kw-hr., 1.1 cents; next 70,000 kw-hr., 0.9 cent; over 100,000 kw-hr. per month, 0.7 cent per kw-hr. A discount of 10 per cent is allowed from the secondary portion of the bill if paid within ten days.

PROGRESSIVE POLICIES IN THE MANAGEMENT OF SMALL CENTRAL STATIONS.

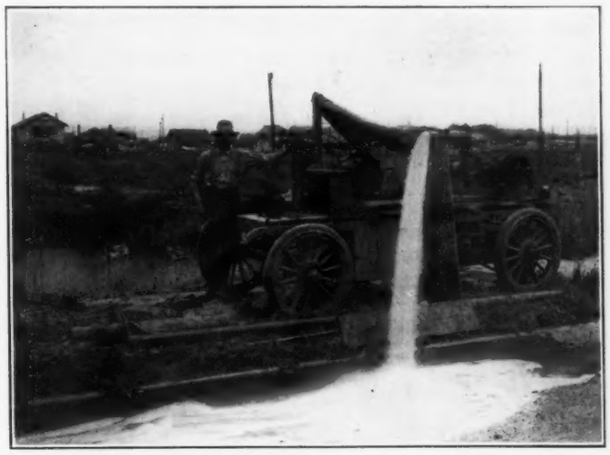
Alva, Okla., is a community of only 5000 population, but it enjoys to an unusual degree the advantages of progressive management which are contributing to the success of public-service properties administrated on a broad-gage basis in larger cities. Mr. N. R. Gascho, manager of the Alva Light & Power Company and past-president of the Gas, Electric & Street Railway Association of Oklahoma, believes in a policy of the utmost frankness and honesty in dealing with customers. He takes pains to convince each consumer that the central station is endeavoring to render economical and efficient service and asks co-operation in securing a "square deal" all around. The patron who is in doubt about the accuracy of his meter is invited to be present in person at a test, when the meter is compared with a rotating standard instrument, care being taken to explain the method of the test. He is also instructed how to check his own meter with his watch, by turning on a 25-watt or 40-watt tungsten lamp or a 16-cp carbon lamp.

The Alva policy concerning its employees is to secure men of a high grade who are a credit to the company in the community, paying these men a self-respecting wage so that they shall be satisfied and ready to devote their full attention to the company's interests. Mr. Gascho believes

that the poorest economy is that effected at the cost of his employees' incomes, and he takes the view that the best investment toward the reduction of operating expenses is the award of a properly earned "raise" to a deserving employee. The practical working of this policy was shown by the result of a recent effort made to decrease the fuel-oil consumption of the plant. A bonus was offered to the engineer for any increase in efficiency he might make, this award to take the form of a fixed addition to his regular salary as long as the specific consumption was not exceeded. Under this stimulation and by careful attention to firing conditions the oil bill was reduced $105 the first month, and the engineer received a bonus increase of $15. The net gain, of course, accrued to the company's profits, but the employee was well satisfied with his increase and with his own success in making the saving.

EMERGENCY ELECTRICAL PUMPING.

Not often are central stations confronted with large quantities of water such as result from four cloudbursts in a period of thirty minutes. Nevertheless, on July 14 nature deluged the country surrounding Denver, Col., with water which drained into Cherry Creek, the channel of which lies in one of the exclusive residence sections of the city. Soon the cement-lined channel, which is some 200 ft. in width, was filled with a raging, roaring torrent, carrying tree trunks, wreckage from residences and much sand toward the Platte River. From 6 p. m. until 11 o'clock at night the rush of waters continued, removing the soil over several acres of land at the Denver Country Club, destroying beautiful boulevards and flooding many cellars in the wholesale business district. By reason of the high



Emergency Pumping Equipment Mounted on Electric Truck.

waters the storm sewers were of little avail and aid was sought from all machinery houses that owned pumps of any type. Electric motors, gasoline engines and muscle were used to operate the pumps, as high as $50 per day being charged without the operator.

The Denver Gas & Electric Light Company had among its vehicles a 2000-lb. General Vehicle truck, upon which was quickly mounted a 5-hp, 220-volt, single-phase, unity-power-factor Wagner motor, belted to a Boggs & Clark pump, the motor operating at 1700 r.p.m. and the pump at 560 r.p.m. The truck was driven to various locations and by means of a 5-in. suction pipe many cellars were emptied of water.

In certain sections of the city water by reason of overflow of storm sewers had accumulated in low-lying spots. The city of Denver, realizing the necessity of removing this surplus water, contracted with the Denver Gas & Electric Light Company for the use of its truck. The accompanying view shows the motor and pump mounted on the truck and rapidly clearing the low-lying portions of all surplus water. The pumping of 36,000 gal. per hour by the equipment soon cleared the land of water that would have proved offensive and disease-breeding if allowed to remain for any length of time.

The charge for the use of the pump was only $2 per hour with a minimum which covered the time necessary for making connections such as suction hose and stringing duplex cable from the single-phase feeders. The time needed varied from twenty minutes to seven hours. The idea of popularizing electric service for pumping purposes, as well as tendering relief to flood sufferers, prompted the preparing of the portable outfit by the consulting electrical engineer of the company, Mr. R. B. Mateer.

INSTALLING CENTRAL-STATION SERVICE IN A DYEING PLANT.

In the following paragraphs are given the various costs and data by which the owners of a large dyeing plant were induced to install central-station service and get rid of an isolated steam equipment of long standing. The investigation made prior to the change showed that with the electric drive, and taking all expenses into account, the yearly cost of operation would be about $1,900 less than with steam. The installation of electric motors has resulted in a greatly improved service to the plant owner.

The establishment was housed in a four-story brick building with a basement and several wings, the organization being engaged in the manufacture of dye woods, dyewood liquors, extracts and articles used in dyeing fabrics. Mechanical drive was used throughout, power being supplied by four engines, four steam pumps also being located in the building. The plant was operated ten hours per day and six days per week, with occasional operation for twenty-four hours per day. The object of the investigation was to determine whether a saving could be made in the cost of operation by replacing the former steam-driven equipment by motors supplied with energy by the local electric lighting company. Power was distributed by shafting and belts in the former installation.

STEAM PLANT.

Steam was generated for the factory in one vertical and two horizontal boilers, the pressure being 85 lb. per square inch. The vertical boiler was rated at 250 hp. It had been in use about six years and was hand-fired. The other two boilers were rated at 150 hp each and had been in service for about two years at the time the investigation was made. One of these boilers was fired with refuse wood from the extractors used in the plant and fed by an automatic stoker. The other boiler was hand-fired. At times the boiler plant was worked very hard and the steam pressure fell as low as 55 lb. It was evident that unless some load was taken from the boilers an additional unit would have to be installed in the near future. It was necessary to use all three boilers in order to maintain the proper steam pressure for the factory, and in the event of a boiler accident it would have been necessary to shut down a part of the plant, with resulting serious expense, until repairs could have been effected.

ENGINES DISPLACED.

On the first floor of the plant was installed a 16-in. by 42-in. Wheelock engine running at 85 r.p.m. This engine ran the main shafting from which was belted most of the heavy machinery, and it was operated ten hours per day. At the time of the investigation the engine was about forty years old and was not in good condition, the valve stems leaking steam very badly. It appeared that the stems could not be packed, and the escape of steam could not be pre-

vented except by considerable repair work. The engine at times carried a considerable overload and indicator cards taken showed that it took steam at throttle pressure for practically the entire stroke, giving no opportunity to secure economy of operation through expansion. The exhaust steam from the engine was passed through a water heater and then allowed to escape to the air.

A 15-hp engine was located in the rear of the first floor of the plant and was used to operate agitators in licorice tanks and an exhaust fan. This engine was found to be very old and in great need of repairs. The steam consumption was clearly excessive. The agitators and fan were belted to a countershaft driven by the small engine, and as the licorice thickened it was found that the engine speed fell off to a maximum of 40 per cent. The exhaust from this engine was piped through the water heater and thence to the atmosphere.

One 5-hp engine running at 500 r.p.m. was located on the second floor of the building and was used to drive an 8-kw, 125-volt lighting generator run on dark days and during evening work. This engine was in very poor repair and was patched with wood. Its efficiency was low. The exhaust steam was treated as in the two preceding cases. The stoker and wood conveyor for the mechanically fired boiler were driven by a 5-hp engine. A small engine lathe and grindstone were also run by this prime mover. The engine was in fair condition, but a good deal of power was lost in the shafting and belting in proportion to the amount utilized. It was apparent that a more efficient drive could be arranged with small outlay. Live steam was used in the extractors and licorice tanks of the plant. Vacuum, water and liquor pumps were also operated by steam. The only use for exhaust steam was in heating feed water for boiler service, except that the exhaust from vacuum and water pumps was used under evaporating pans. Coal was delivered to the boiler room daily on account of inadequate storage facilities, and water was purchased for all applications. The labor requirements of the plant called for one engineer, two firemen on a day shift and one fireman for night work.

ESTIMATED COSTS.

In estimating the cost of operation by steam the following items were taken into account:

Interest, Taxes and Insurance.—In this case the sums charged to those items were very small, as the salvage value of the engines and pumps was very low on account of their age. The boiler plant was in better condition and therefore carried higher charges. No charge was made against the steam engines and pumps for interest, taxes and depreciation, on account of their poor condition.

TABLE I.—COST OF OPERATION BY STEAM.

Item.	Cost.
Interest, taxes and insurance, boilers	$100
Depreciation	....
Repairs and renewals	1,200
Coal	3,564
Water	258
Ashes, removal	70
Labor	2,652
Total for one year	$7,844

Repairs and Renewals.—An allowance of $1,200 per year was made for these items, although it appeared that this amount would for a time at least be inadequate to the needs of the situation. Both boiler and engine equipment were in need of substantial improvements.

Coal.—In estimating the coal consumption for a year, 300 days of operation were assumed. From observations of the service performed by each machine, engine and pump it was estimated that 891 tons would be required yearly on the basis of operation above stated, costing at $4 per ton $3,564. The evaporation figure was 8 lb. of water per pound of coal.

Labor.—The salaries of the operating force totaled $2,652 per year. Water, ashes and the other items of cost are summarized in Table I.

ELECTRIC DRIVE.

The figures given were, the plant owner agreed, as favorable to his existing installation as was possible. The omission of any depreciation charge and the nominal interest, tax and insurance charge assumed were both disadvantageous to electricity. The problem for the central-station organization was to show operating economy over a plant which was of little value from the investment point of view, on account of the extent to which depreciation had decreased the worth of the plant. The electric-motor installation required is shown in Table II.

TABLE II.—ELECTRIC DRIVE IN DYE-MANUFACTURING PLANT.

Machines Driven.	Motor Horse-power.
Logwood cutter (A)	35
Logwood cutter (B)	35
Licorice cutter	5
Elevator	5
Tumeric cutter	5
Schultz-O'Neill mill	25
Wood conveyor and screens (C)	5
Wood conveyor and screens (D)	5
Screw conveyor	5
Licorice agitators and fans	10
Stoker and conveyor	3
Machine shop	2
Air pump	10
Licorice pump	3
Total	153

All these motors were of the three-phase, 60-cycle induction type, wound for 500 volts. The cost of the motor installation was $2,029. The sizes of the motors were figured rather closely, but the service was highly intermittent in character. The average cost of wiring was taken at about $3 per hp. On account of the high speed of most of the machines it was found that in most cases the motors could be belted directly to them, thus making the cost of millwright work nominal. An allowance of $100 was adequate for this item. The item of heating was omitted from the cost of operation in both steam and electric service. The item of labor in figuring the cost of operation by electricity was taken as the wages of two firemen at $624 each per year, or a total of $1,248 per year. It was pointed out that the night man could attend to such little cleaning as the motors require. The energy consumption of the factory was determined to be 14,864 kw-hr. per month, giving a net bill of $4,459 per year. Table III summarizes the yearly cost of operation by electric power.

TABLE III.—COST OF OPERATION BY ELECTRICITY.

Item.	Cost.
Interest, taxes, insurance, depreciation	$200
Repairs and renewals	25
Labor	1,248
Energy	4,459
Total for one year	$5,932
Saving by installation of electric drive, per year	1,912

Emphasis was laid in the report of the investigation upon the point that the cost per hp-hour delivered increased as the load decreased with the steam plant.

Wiring and Illumination

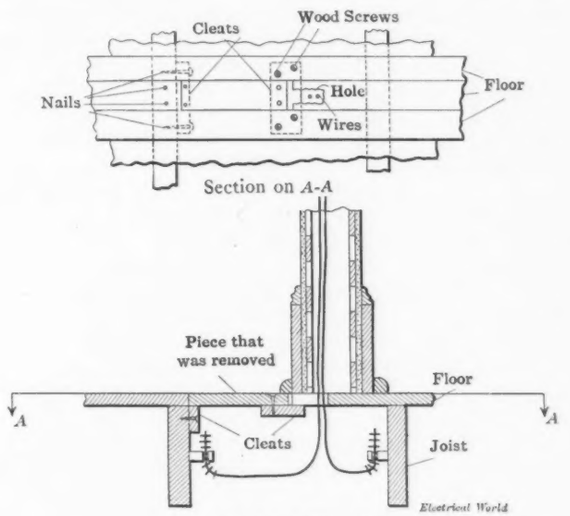
WIRING OLD HOUSES—III.

Methods Employed by the Allegheny County Light Company—Partition Wiring—Wall Outlets.

BY TERRELL CROFT.

The two previous instalments of this article, which appeared in the issues of July 13 and July 27, described the new-business campaign inaugurated by the Allegheny County Light Company, the method of securing the co-operation of local wiring contractors, and the construction methods employed in making wiring installations of this class. The present instalment continues the description of methods employed in installing concealed wiring, with particular reference to the mechanical difficulties to be overcome in old houses of both frame and brick construction. Much attention is given to the best methods of preparing wire routes in partitions and opening passageways around or through hidden obstructions.

Where wires must be run in a partition to a switch or fixture outlet and it is impossible to get at the top of the



Sectional Elevation

Fig. 20—Method of Running Wires from Floor Pocket to Partition Above.

partition, they must be carried up from the space under the floor below. Fig. 20 illustrates a method of making an opening from the space under a floor into the space in a partition. After a small hole has been cut in the partition at the point where the fixture outlet is to be located and a "mouse" dropped down through the hole to the floor to insure that there are no obstructions within the partition, a pocket is made by removing a floor board. The pocket is located adjacent to the point where the wires within the partition are to pass through the floor. A floor board piece is cut out, as shown in Fig. 20. The "quarter-round" at the baseboard is removed for a few feet and one saw cut is made through the floor board that is to be removed (as described earlier) close to the baseboard, where it will be covered by the "quarter-round." The other saw cut through the floor board is made close to a joist several feet from the partition.

After the floor board has been removed a hole is chiseled under the partition, as indicated in Fig. 20, through which the loom-covered wires are drawn. In replacing the removed floor board two cleats are needed to support it. The cleat at the end of the board farthest from the partition is nailed to a joist as before described. The cleat at the end near the partition is held up with flat-head wood screws driven in from above. Although the removed floor board shown in Fig. 20 extends only to the first joist away from the partition, it is better practice, as noted before, so to cut a floor board that it will bridge several joists.

A 2-in. by 4-in. sill is sometimes placed under the lower

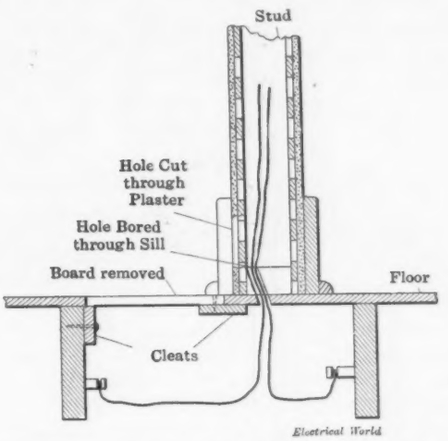


Fig. 21—Method of Cutting Through 2-in. by 4-in. Sill.

ends of studs that form a partition, as shown in Fig. 21. Where this construction is encountered and it is not possible to bore through the sill from above with the long-distance boring tool, the baseboard must be removed as shown. After the baseboard is off an orifice is cut through the lath and plaster and a slanting hole is bored through the sill and the floor. Sometimes it is not necessary to bore the hole as the wires can be run in a space formed by removing some lath and plaster, as suggested in Fig. 22. Where large conductors are involved it is usually necessary to bore through the sill.

Fig. 23 illustrates a method of running vertical conductors within a partition that is braced with bridges. In the case shown it was not feasible to bore down from above with the long-distance boring tool, so the conductors were

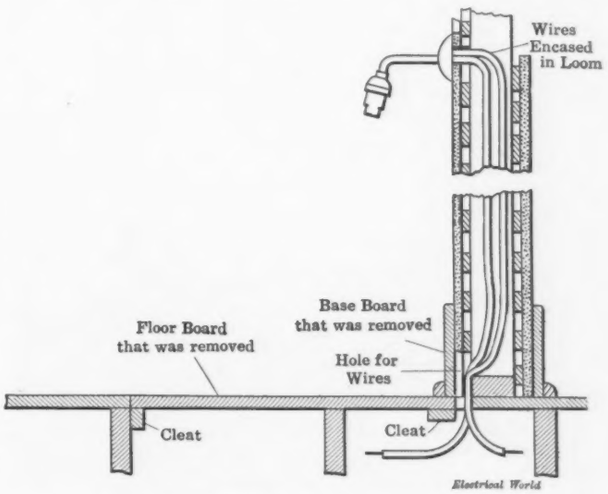


Fig. 22—Method of Wiring Around a Sill.

carried up from below. The scheme can be utilized only at the side of a doorway. The door-jamb in such a case can either be pried loose and bent up, as shown at *B'* (Fig. 23) or a saw cut can be made in the jamb as at *C* and the section *B* of the jamb can be removed. In either case the stud at the side of the door is exposed and wire ways can be cut in its outer face around bridges or other ob-

structions, as shown. At the floor a hole can be cut through the stud, as shown at *D*, and through this hole another can be bored through the floor. The conductors are then carried through this floor hole into the space between the joists. The Pittsburgh wiring rules, like the code rules, require that all conductors within partitions and not supported on porcelain be carried in circular loom. Allowance must be made for this in boring holes and cutting wire ways.

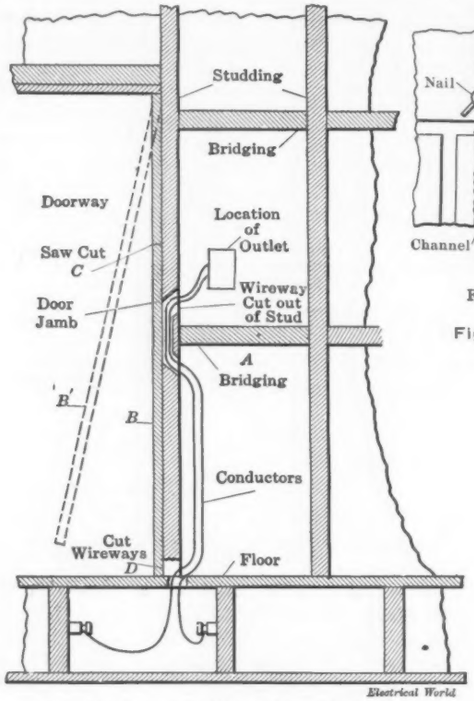


Fig. 23—Carrying Wires Around a Bridge.

A method of running conductors to an outlet in a brick wall with minimum damage to finish and cutting of bricks is shown in Fig. 24. The baseboard is not removed. A cavity is cut for the metal outlet box (all conductors in brick walls must be protected with iron armor) and a groove is cut in the wall surface from the outlet cavity down to the baseboard. From this point a slanting hole is drilled to a pocket opening between the joists. To cut this pocket it was necessary to remove some floor boards. (See Fig. 24.) Flexible steel-armored conduit is then connected to an outlet box, the box is fastened in the cavity provided for it by a screw turning into a lead expansion anchor, and the conduit is run through the hole back of the baseboard and placed in the groove. Fig. 25 shows two forms of drills for piercing bricks. The star drill is a commercial article and can be purchased at any general hardware store. It is forged from steel drill rod. The other drill can be made from a length of conduit by the wireman himself, by filing teeth with a three-cornered file in one end; but a drill of this kind does not wear well. However, a good drill of the form shown at *B* (Fig. 25) can be made from extra-heavy steel pipe, which can be obtained at any plumbers' supply house. For general work in reasonably soft walls the pipe drill is preferable to the star drill. The cutting edges of the star drill frequently break off, rendering it useless, and sometimes obstruct the hole. In deep holes the pipe drill "clears" itself much more effectively than the other.

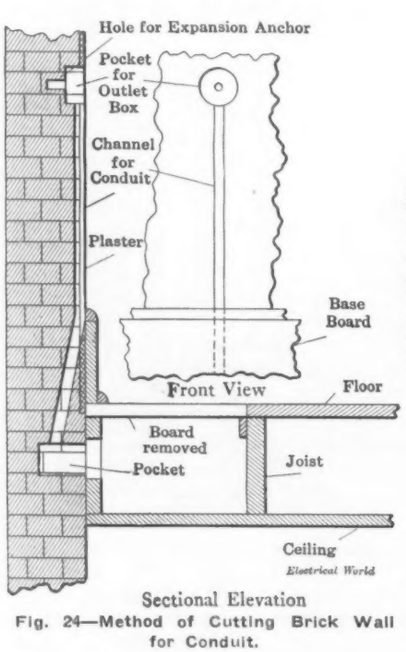


Fig. 24—Method of Cutting Brick Wall for Conduit.

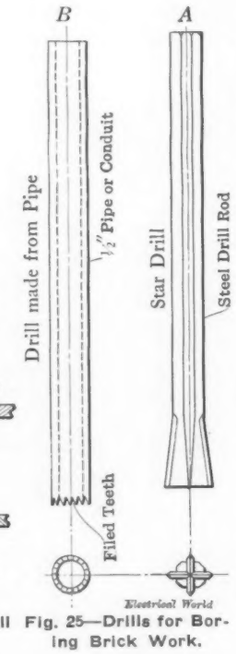


Fig. 25—Drills for Boring Brick Work.

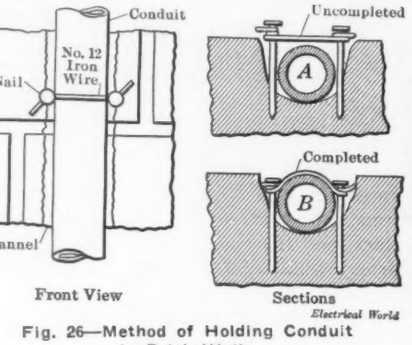


Fig. 26—Method of Holding Conduit in Brick Wall.

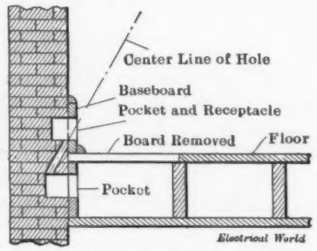


Fig. 27—Pockets in Brick Wall for Receptacle.

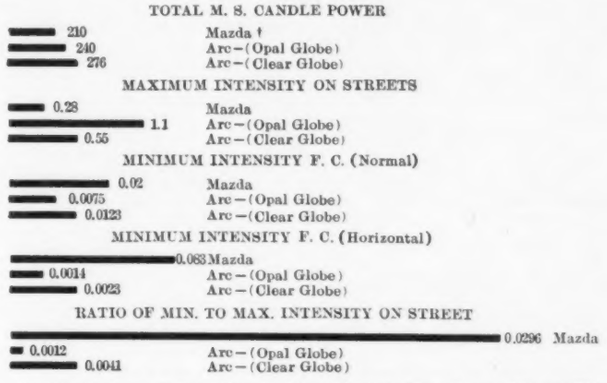
Fig. 26 shows a good method of holding conduit in a brick wall. Pipe straps are sometimes used for the purpose, but the method illustrated is preferable in the respect that the materials required are always at hand. As shown in the section at *A* (Fig. 26), after the conduit is in place in the groove cut in the brick two nails are driven part way in, on opposite sides of the conduit. The ends of a piece of wire, say, of No. 12 galvanized iron, are twisted around the nail under the heads, the wire bridging the conduit. The nails are then driven home and the wire will grip the conduit tightly as shown at *B* (Fig. 26) and hold it firmly in place. Such supports should be located about every 2 ft. along a length of flexible conduit. After the conduit and outlet boxes are in position in a wall the spaces around them should be filled up, flush with the wall surface, with plaster of paris.

Where channeling a brick wall for a fixture outlet at the regulation height of 4 ft. 6 in. from the floor would be objectionable, the method suggested in Fig. 27 can often be satisfactorily substituted. This method consists of installing a receptacle for an extension plug in the baseboard. By means of an extension cord a portable or table lamp can be substituted for a wall fixture. It will be noted from Fig. 27 that it is not necessary even to remove the baseboard. A slanting hole is drilled from the pocket for the baseboard receptacle to another pocket cut beneath the floor. A short piece of conduit is then installed from the receptacle outlet to the pocket under the floor. Such a baseboard receptacle also forms a convenient means of attachment for portable vacuum cleaners and heating devices.

The next and last instalment will describe the construction and installation of panel boxes and the use of blow torches.

TUNGSTEN LAMPS FOR GENERAL STREET LIGHTING.

The comparative light distribution and operating costs of tungsten and arc lighting for principal and secondary city streets were discussed by Mr. H. H. Magdsick, of the National Electric Lamp Association, Cleveland, Ohio, before a recent meeting of the Minnesota Electrical Association.



A Comparison of the Illumination Produced by 4-amp Magnetite Arcs and 60-cp Tungsten Lamps for the Same Annual Expenditure.

Ornamental standards with from one to six tungsten lamps have met with the greatest favor in the lighting of business streets, said the speaker. This system satisfies the demand for an installation of the proper intensity, artistic by day and at night, free from flicker and glare, and with a reasonable uniform distribution. It is also sufficiently flexible so that it may be adapted to meet the conditions of intensity and design required in different communities. Considered from all standpoints, more satisfactory results are obtained with incandescent lighting and at a lower operating cost than with ornamental arc installations. Multiple wiring can be used, and this, in addition to being cheaper than a series circuit, eliminates all danger from high voltages. When standards with a number of lamps are used a three-wire system which allows all but one of the units to be switched off can be installed at a small added cost. One lamp per post will thus be left lighted and the street will receive a more uniform and satisfactory illumination than under the arc-lamp system.

On secondary streets, where less money for illumination is available and traffic is not so dense, small incandescent units can be used to advantage along the curb. Comparing an arc illumination using one 4-amp magnetite lamp on each corner with four 60-cp tungsten lamps to a block, spaced at 112-ft. centers, the light-distribution and cost figures reproduced herewith are obtained.

COMPARATIVE COSTS—MAGNETITE AND TUNGSTEN LAMPS.

	4-Amp Magnetite Arc.	60-cp Tungsten Lamps.
Watts at lamp terminals	310	71
Efficiency of distribution lines, per cent	92	92
Efficiency of transformers, per cent	..	96
Efficiency of transformer-rectifier sets, per cent	85	..
Watts at substation	396	80
Power-factor of circuit, per cent	67.5	87.5
First cost of lamps	$25.00	$0.77
First cost of fixtures and substation equipment	30.00	6.50
First cost, total	$55.00	$7.27
Annual maintenance cost, 4000 hours' service:		
Interest and insurance, 6 per cent	$3.30	$0.44
Depreciation on permanent parts, 12½ per cent	6.87	0.81
Lamp renewals, three at 77 cents	.....	2.31
Labor for inspection or cleaning	0.75	0.60
Repairs to lamps and equipment	2.00	0.25
Electrodes, positive, one at 60 cents	0.60	.....
Electrodes, negative, twenty-three at 5 cents	1.15	.....
Globes, one at $1	1.00	.....
Rectifier tubes	3.00	.....
Trimming, twenty-three at 7½ cents	1.72	.....
Total	$20.39	$4.41
Energy, 4000 hours:		
1 cent per kw-hr. at 87½ per cent power-factor	.....	$3.20
1.1 cent per kw-hr. at 67½ per cent power-factor	$17.42	.....
Total operating cost, 4000 hours per year:		
Energy at 1 cent (at 87½ per cent power-factor), 1.1 cent at 67½ per cent power-factor	$37.81	$7.61
Energy at 2 cents	55.23	10.81
Energy at 3 cents	77.65	14.01
Energy at 4 cents	90.07	17.21
Energy at 5 cents	107.49	20.41

IDENTIFICATION CARDS FOR LINE CREWS.

The street-railway companies in Chicago have sustained serious losses from the theft of copper cable, especially in the negative-return system, where sections can be removed without the immediate knowledge of the operating department. Accordingly instructions have been issued to the police department to have a patrolman approach any crew working on the lines and demand the foreman's identification card. These cards are issued to the construction and repair departments under signature, and careful record is kept of the location of each. For comparison, similar cards have been prepared for the police, and the officers have orders to arrest the members of any gang found doing line work without identification.

COMBINATION WHITE-WAY, POLICE-CALL AND FIRE-ALARM POSTS AT FORT WORTH.

In erecting its new ornamental tungsten-lighting system of 200 curb posts, each carrying five 100-watt lamps, Fort Worth, Tex., has utilized the corner posts for fire-alarm and police-call purposes, being doubtless the first American city to put into use this logical combination of curbside structures. The 100-watt multiple tungsten lamps are arranged on "midnight" and "all-night" circuits, each controlled by switches at fire headquarters. The pressed-steel columns of the posts have special gains to carry the fire and police-call boxes. Each of the forty-five posts carrying fire-alarm boxes has its topmost lamp inclosed in a frosted globe surrounded by a broad red band bearing the words "Fire Alarm." These lamps burn continuously. The thirty-five police-call posts are similarly equipped with green-band globes on the uppermost lamps. Although normally burning continuously, these signal lamps are controlled by battery-operated magnet contactors in the base of the poles,

Combination White-Way, Police Call and Fire-Alarm Posts at Fort Worth.

operated over a circuit from police headquarters. With their aid the number of any patrolman wanted can be flashed from headquarters, a bell on each post meanwhile giving a corresponding audible signal. The base of each signal-box post contains a complete junction board for transferring cable connections. The Fort Worth signaling systems are being installed by the Gamewell company and are probably the first to make such combined lighting, fire and police-call use of the curb posts.

RECENT TELEPHONE PATENTS.

NEW CIRCUITS

Mr. H. G. Webster, of Chicago, has obtained a patent for a switchboard circuit system of what he terms the "one-wire" type, because but one side of the circuit is carried through the multiple-jack system. With such a system one side of each line is permanently connected to one pole of the battery. The present patent relates particularly to the control of the supervisory signals in the cord circuit. This signal is controlled by a two-stage relay. If the relay acts completely, the lamp is out. If it is de-energized, the lamp is out. In the mid position the lamp circuit is maintained. It is this mid position which corresponds to the plug in the jack of a line and the path to battery from the jack of high resistance. With the response of a station the line relay operates to close a low-resistance path which permits the supervisory relay to complete its action. This patent is assigned to the Kellogg Switchboard & Supply Company.

The patent granted to Mr. F. C. Unger, of St. Louis, is for a magneto system, in which, however, the signal generators are at the central office. The line and clearing-out drops are connected between the generator bus and a neutral point at the middle of two impedance coils bridged across the line. As the hook switch at any station rises, it momentarily grounds both sides of the line simultaneously. The generator current thus finds a path to ground and throws the drop. A separate generator is used for ringing the bells.

DISINFECTING DEVICE.

A disinfecting device for transmitters forms the subject of a patent granted to Mr. A. E. Le Ford, of Boston. This has the appearance of a truncated cone with the small end turned in. The face of the cone is of a size just to receive the circular transmitter face. At the same time the turned-in point will just fit and extend within the transmitter mouthpiece. This forms a compartment around the transmitter mouthpiece. To this compartment a disinfectant container is attached. The fumes accumulated within the disinfecting device are admitted to the mouthpiece through a row of perforations through the wall of the inturned end.

Letter to the Editors

RESIDENCE RATES.

To the Editors of Electrical World:

Sirs:—It appears that the rate question, especially as regards residence load, is as far from solution as ever, and that residence load is looked upon in some quarters as a losing venture. In fact, some central-station men have gone so far as to say that a load of this kind is undesirable because it costs the central station more to supply the energy for it than it receives. Surely such statements are not to be taken seriously, or else they indicate that the entire central-station industry is tottering on the brink of destruction, which is, of course, untrue. Evidently knowledge of the industry is lacking, for the fallacy of such statements is at once apparent when they are set over against the actual facts.

There are in this country approximately 6000 central stations. Of these approximately 5000 are rated at 500 kw or under, and 4000 have ratings of 200 kw or less, so that the average central station of the United States is a rather small affair. Investigation would also show that the entire load of these stations is made up of residence, business and public lighting. Even in what are termed first-class cities the income from lighting represents about 70 per cent of the total, so that, taking the country as a whole, central stations to-day are supplying energy for lighting circuits chiefly, and by far the great majority of their customers fall into what may be termed the residence class.

The average energy consumed by residences in cities is 15 kw-hr. monthly, or from 180 kw-hr. to 200 kw-hr. yearly. Now, there is no system of rates so far devised of which the writer knows that when applied to a load of the proportions mentioned will give the consumer the benefit of any reduction in cost. During certain seasons of the year residence customers, as a rule, pay the minimum rate in force, and generally speaking such customers at all times pay the highest rate for whatever energy is consumed. It is therefore amusing, to say the least, to listen to long-drawn-out papers and discussions of rates dealing with residence loads in which the authors expatiate on the graded discounts available, when in 90 per cent of the cases residence customers do not use enough energy to bring them within viewpoint of any system of discounts in vogue.

A perusal of the technical press and association proceedings discloses a tendency for central stations to get farther and farther into the rate-question mire. Very little effort seems to be directed toward a simplification of rate schemes, so that despite the years of thought spent on this matter there still are almost as many rate schemes as there are central stations. The legality of some of the new schemes proposed, especially those fixing the demand on an arbitrary assessment system of so much per lamp or outlet or basing the system of charge on floor area, is questionable. As an abstract legal proposition, it is difficult to see why a central station should concern itself with the size of a man's residence or with the number of lamps he has connected except to guide it in the choice of mains and meters. What a central station sells is electrical energy and this is measured by kilowatt-hour meters. Experience has shown that the consumption in residences is fairly constant, varying very little from year to year, so that a straight meter rate is logical. Where, however, a manager has scruples against such a system of charging, it is possible to ascertain the maximum demand by means of a meter suitable for that purpose without infringing upon the rights of the owner and without using arbitrarily a certain percentage of the lamps connected in certain rooms. There are, to be sure, some managers who would object to the statement that they merely sell electrical energy and who would insist that they sell service. The word "service," however, is akin to the word "ether" as used by some physicists, in that it is very hard to define and, most important of all, impossible of measurement, so that it would appear that "service" is a new "will-o'-the-wisp."

Of all the systems of charging for residence service now in vogue the straight rate and the maximum demand are the most simple, and in view of the statement made above the maximum-demand system really "simmers down" to the straight-rate system. It would appear, therefore, that the time is ripe for the adoption of some such simple system of charging for residence load before public-service commissions insist upon it. The avidity with which the municipal ownership doctrines are being absorbed in certain sections of the country also indicates that action must be taken quickly.

Buffalo, N. Y. H. G. Briggs.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Single-Phase Railway Motors.—An illustrated description of the Bergmann single-phase railway motor. The object of the designers was to provide a series motor with brush regulation, and they have succeeded in developing a design in which a suitable commutating field is obtained throughout the entire range of brush displacement. The new arrangement consists in the main of a special arrangement of the compensating winding. Whereas hitherto the single coils per pole were always connected in series, in the Bergmann design they are connected in parallel and the number of turns of the individual coils is calculated according to known laws. By accurate calculation of the number of turns, taking into account the ohmic resistance, leakage coefficients, etc., it has been possible by this method of winding to develop in the commutation zone a suitable reversal field for all positions of the brushes when brush regulation is used. The design also enables more power to be developed by the motor, just as direct-current machines with interpoles can be loaded more heavily than can machines without interpoles. An accurate test shows that the distribution of the total current varies in the individual coils when the brushes are displaced, and by suitable allocation of the windings it is possible to insure that the current will so vary over the different coils that a correct reversal field will always exist in the brush line of commutation, so that sparkless commutation is attained at all loads and speeds. A further innovation by which the brush regulation in Bergmann series motors has been greatly improved consists in using several voltage steps. On starting up, the motor is switched on to the lowest voltage step and the brushes are gradually rocked forward, then brought back, switched on to the next voltage step and again rocked forward. By this method the current consumption at starting is very considerably reduced and is practically no higher than in the ordinary series motor. Moreover, the power-factor is relatively high and the use of induction regulators with their large leakage is dispensed with. Although each voltage step requires one more main switch, the latter is not exposed to heavy wear. The characteristic curves of a 2000-hp motor are given in Fig. 1. Some details are given of the behavior of a 1500-hp locomotive driven by such a motor.—London *Electrician*, July 19, 1912.

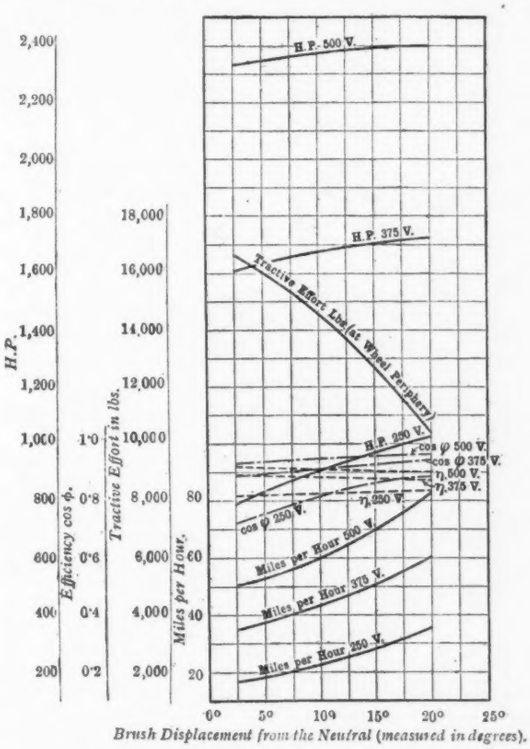


Fig. 1—Characteristics of a 2000-hp Motor.

Losses in Induction Motors Due to Eccentricity of the Rotor.—C. F. SMITH AND E. M. JOHNSON.—An account of an investigation which was undertaken with the object of ascertaining the magnitude of the additional losses in a motor brought about by a progressive increase of the eccentricity of the rotor, and of thus obtaining information as to the amount of eccentricity which may be allowed in practice without serious disadvantage. The authors summarize their conclusions as follows: A displacement of the rotor of an induction motor from its central position results in a change of the flux density along the axis of displacement, which is approximately proportional to the change in the magnetic permeance of the air-gap when the rotor is open-circuited. A closed rotor winding having a single circuit per phase hardly alters this distribution of flux at all. A multiple-circuit winding on the rotor becomes the seat of balancing currents which are sufficient to maintain an almost uniform mean flux round the air-gap irrespective of the rotor displacement. The balancing currents are strictly limited in value and are not great enough to produce any serious increase in the rotor copper losses with moderate displacements of the rotor. The asymmetry of the field due to rotor eccentricity, when not compensated by rotor currents, gives rise to an additional iron loss, which increases uniformly with small eccentricities; with larger eccentricities the losses increase rapidly. Increased eccentricity is also attended by less favorable starting of the motor and by a diminished magnetizing current. The unbalanced magnetic pull on the eccentric rotor increases at first slowly, but afterward at a higher rate, with increase of eccentricity. With a multiple-current rotor winding no appreciable iron losses or unbalanced magnetic pull is produced even by extreme values of the eccentricity. The total effect of rotor eccentricity on the losses of the motor was found to be very small for all displacements when the multiple-circuit type of winding was used; with the single-circuit-per-phase winding the increase in losses was more marked, but did not become important for eccentricities less than 20 per cent of the length of the original air-gap.—London *Electrician*, July 19, 1912.

Polyphase Commutator Motors.—R. RÜDENBERG.—The first part of a long mathematical paper illustrated by numerous diagrams. After giving the vector diagram of polyphase motors, the author discusses the characteristic features of the series polyphase commutator motor. The article is to be continued.—*Bull. Ass. des Ingen. Elec. de l'Inst. Elec. Montefiore*, April, 1912.

Lamps and Lighting.

Incandescent-Lamp Vacuum.—A note on a recent British patent (No. 19109, July 4, 1912) of the British Thomson-Houston Company, Ltd., and H. H. Needham. To improve the vacuum by the insertion of a suitable quantity of phosphorus in the lamp bulb, a phosphorous compound (phosphide) is coated on the leading-in or supporting wires before assembly. This is accomplished by heating them to a temperature of from 400 deg. to 500 deg. C. in an atmosphere of hydrogen and phosphorus. The supports must be formed of a metal which will form a phosphide such as copper, nickel or molybdenum.—London *Elec. Engineering*, July 11, 1912.

Electric and Kerosene Lighting.—Berthold Monasch.—The author criticises a recent comparison by J. Singer of the cost of electric and kerosene lighting which was based on a comparison of the horizontal candle-powers. This is incorrect, and the present author gives a comparison of the specific consumption on the basis of the real illumination in lux per square meter of illuminated area. It is shown that lighting with tungsten lamps is cheaper than with kerosene lamps, when the kw-hr. costs less than 23.125 cents, if one liter of kerosene costs 5 cents or 1 gal. 19 cents.—*Elek. Zeit.*, July 18, 1912.

Generation, Transmission and Distribution.

Italian Water-Power Plant.—The first part of a long illustrated description of the water-power plant of the Adamello Electric Supply Company. The water-powers of various Alpine streams are utilized, and since the water supply is lowest in winter, when the greatest amount of power is required, water storage is employed on a large scale. Several existing lakes have been built into huge reservoirs. The plant is now at work and generates the necessary energy for other companies, which in turn supply it in smaller quantities to consumers. Its operations are carried on in seven different provinces: Brescia, Bergamo, Milano, Como, Piacenza, Parma and Cremona. The stations of this company obtain water from the Poglia basin, which extends over a total area of 91 sq. km (37 sq. miles). There are two plants, the Isola and the Cedegolo stations, the latter containing 5000-hp turbines driving 5000-kva, three-phase alternators. Energy is generated at a pressure of from 9000 volts to 12,000 volts with a frequency of 42, a permanent overload of 10 per cent being permissible. The maximum excitation power required is 22 kw. The high voltage of the generators is necessary on account of the fact that the Cedegolo station is required to run in parallel with the Isola station, situated a distance of about 5 km (3 miles) away, in which energy is generated at 12,000 volts. The exciting energy for the alternators is obtained from two shunt-wound generators with interpoles, one of which is driven by a turbine and the other by a 500-hp synchronous motor working at a pressure of 220 volts. These two exciters supply a current of 2700 amp at 125 volts. There are fifteen single-phase transformers, connected in delta on both the primary and secondary sides. Each of the transformers has a rating of 2700 kva at a pressure of 60,000 volts, which may be increased to 72,000 volts in case one of the lines has to be cut out of circuit and the entire energy transmitted by the other line alone.—London *Electrician*, July 19, 1912.

Turbo-Alternators.—The conclusion of a long illustrated article on Curtis turbo-alternators. In the present instalment the design of alternators suitable for direct coupling is described.—London *Electrician*, July 19, 1912.

Traction.

Electric Point Setting.—J. Simey.—An illustrated description of various automatic methods of point setting and switch control on railroads and tramways.—*La Lumière Elec.*, July 13, 1912.

Installations, Systems and Appliances.

Erection of Large Steam Electric Stations.—G. Klingenberg.—The first part of a paper read before the German Association of Electrical Engineers. The author first gives some typical load curves and then discusses the design of the machine house in a large steam electrical station. The advent of the steam turbine has revolutionized the design of large power stations, as a result of the much lower first cost of large steam-turbine units. The steam pressure has been standardized as from 12 to 14 atmospheres and the steam temperatures as from 300 deg. to 325 deg. C. Neither can be raised much, but it is possible and would be advantageous to increase as much as possible the limit of the capacity for all the standard speeds (3000, 1500, 1000 r.p.m., etc.). The difficulties are less in the design of the turbine than in that of the generator, for which the ventilation must be improved. The higher the first cost of the steam turbine the lower the steam consumption. The type is, therefore, to be selected according to the mean yearly load and the cost of fuel. If the fuel is cheap and the load-factor low, a cheap design is profitable, while a more expensive design with a low steam consumption is to be preferred when the fuel is expensive and the load-factor high. As to overload capacity, attention is called to an important difference in definition between English and German practice. In English specifications it is usually required that a turbine must be able to carry a certain percentage overload continually. According to German practice, the maximum load which a permanent turbine can carry permanently would be called the normal load and an overload of 25 per cent above this is required for two hours only. It is a disadvantage that this overload range of the machine is guaranteed only when cold. In order to reduce the first cost, machines of as large load range as possible are selected. It is true that the cost per kilowatt does not decrease considerably for sets above 500 kw, but the space required and the cost of the machine house and of the auxiliaries are considerably reduced. Large units have a smaller steam consumption at high load and the cost of attendance is less, but with a larger number of smaller units it is possible to handle load fluctuations more advantageously. The final decision as to the size of unit, therefore, depends on the load-factor and on the form of the load curve, and the decision should be reached on the basis of a calculation making use of the characteristic curve of steam consumption. This is explained by a diagram. The author then deals with the generation of the exciting current and with auxiliaries. As to electric or steam operation of auxiliaries, European practice is in favor of steam operation for the sake of greater reliability. The paper is to be concluded.—*Elek. Zeit.*, July 18, 1912.

Oil Switches.—F. Marguerre.—The conclusion of his illustrated paper on a series of experiments made with a number of different high-tension oil switches. The results obtained with the different switches are described and plotted in the form of curves and oscillograms. One peculiar result obtained is that with all types tested the breaking of a circuit of from 40,000 kva to 50,000 kva at voltages of from 12,000 to 13,000 after opening the circuit in case of a real load is much easier than the breaking of a circuit with 10,000 kva to 20,000 kva at from 3000 volts to 4000 volts when a short-circuit is opened. This conclusion is based on not only the oscillograms but also the behavior of the switches.—*Elek. Zeit.*, July 18, 1912.

Wires, Wiring and Conduits.

Cable Fracture.—E. Suenson.—An illustrated article on a peculiar fracture in a submarine cable of the Great Northern Telegraph Company. The special features of this fracture are described. The fracture appears to have been caused by the material having been fatigued by many thousand bends or twistings. Since repeated twistings generally produce a fracture with a screw surface and as the fracture in this case had a plane surface, the breaks must have been caused by either stress or bending tensions. Such tensions might be due to the flood carrying the cable toward the coast and the ebb drawing it out again, but the number of these movements would be far too few in the short time the cable had been lying in this track to be of any consequence. If, on the other hand, the cable had been suspended between two submarine rocks, it is just possible that the outflowing mud could have acted on the cable in the same way as the violin bow acts on the string, by carrying it along until the strain grew so heavy that the cable sprang back, when it would again have been seized by the outflowing mud, and so on. Neither explanation is believed to be very satisfactory.—London *Elec. Review*, July 19, 1912.

Aluminum Conductors.—A diagram for the rapid and

exact determination of the deflection and stress in overhead conductors of aluminum. The diagram gives the relations between stress in pounds by square inch, the span in feet, the deflection in feet and the temperature.—London *Elec. Review*, July 19, 1912.

Electrophysics and Magnetism.

Electric Behavior of Metallic Vapors in Filaments.—E. N. DA C. ANDRADE.—An account of an experimental investigation, the main results of which are as follows: Negatively charged luminous metallic carriers can exist in a flame, in addition to the known positive carriers. If a streak of metallic vapor stand between, but not touching, two electrodes in the flame, Ohm's law holds for the conductivity of the vapor within the observed range. If a cooled negative electrode be employed, with a given voltage, a definite maximum current is obtained in displacing a luminous metallic vapor streak between the electrodes toward the negative electrode in the flame. An estimate of the number of free electrons produced per second in the streak may be obtained from this. The conductivity and energy of light emission of a streak of metallic vapor are proportional within the observed range. The energy of light emission for a given rate of vaporization of metal is roughly independent of the pressure. The velocity of migration of the positive carriers of the luminous streak is inversely proportional to the pressure, and hence the fraction of the time during which a carrier is positively charged is independent of the pressure. This leads to the theoretical conclusion that the impact of metal atom against metal atom is the main cause of the liberation of an electron from a metal atom.—*Phil. Mag.*, July, 1912.

Skin Effect.—P. GIRAULT.—To illustrate the phenomenon of the skin effect in a conductor with circular cross-section the author gives a vector diagram in which the vector represents the current density at different distances from the center of the conductor. In passing from the center along a radius to the outside the end point of the vector, representing the current density, describes a spiral, amplitude and phase increasing continually from the inside to the outside. This spiral surrounds the zero point the more often the greater the electric conductivity and the permeability of the conductor and the frequency and the diameter of the conductor.—*Elek. Zeit.*, July 11, 1912.

Emission Velocities of Photo-Electrons.—A. L. HUGHES.—An abstract of a recent (British) Royal Society paper. This investigation was undertaken to determine the relations between the maximum velocity with which electrons are emitted from metallic surfaces illuminated by ultra-violet light and (a) the wave-length of the light and (b) the nature of the metal. The form which this relation takes is given, more or less definitely, by different theories of the photo-electric effect, and therefore criteria between different theories would be given by accurate experimental evidence on these two relations. Two laws connecting the maximum emission velocity and the wave-length have been suggested. The first, due to Ladenburg, is that the maximum velocity is proportional to the frequency. The second, based originally on the quantum theory, is that the energy of the fastest electrons is proportional to the frequency. The experimental evidence at present available is inadequate to discriminate between the two theories. From the experiments which have been published on the velocities of photo-electrons it is clear that the velocities vary enormously with the state of the surface. The effect is due to the presence of a variable gaseous film on the surface which reduces both the velocity and the number of electrons passing through. In this research metallic surfaces were prepared in such a way that it is extremely unlikely that any surface film could be formed. The maximum velocities of the photo-electrons from a continuously forming surface of mercury were measured. Surfaces of Ca, Mg, Cd, Zn, Pb, Bi, Sb, As, Sc and $ZnCl_2$ were prepared by distillation in a liquid-air vacuum and were exposed to the light without having been in contact with air or other gas. From experiments with the surfaces of distilled metals it was concluded that the maximum energy, and not the maximum velocity, of the photo-electrons was proportional to the frequency.—London *Electrician*, July 12, 1912.

Electrochemistry and Batteries.

Electric Smelting of Zinc Ores.—W. R. INGALLS.—A paper presented before the Canadian Mining Institute on the present status of electric zinc smelting. The author deals with the use of carbon or iron as reducing agent, different types of furnaces, differences of electric zinc smelting from ordinary practices, the effects of carbon dioxide, the speed of reduction, the matter of temperature, results of smelting at Trollhättan, the possibility of simultaneous recovery of lead, condensation and formation of blue powder, cost of smelting, and limitations of the process.—*Met. and Chem. Eng'ing*, August, 1912.

Condensation in Electric Zinc Smelting.—An editorial on the difficulty experienced with many electric zinc furnaces in that the zinc vapor condenses into blue powder instead of liquid zinc. This may be due either to faulty physical or faulty chemical conditions or to both. In the same way in which water vapor may condense into snow instead of rain, zinc vapor may condense into blue powder instead of liquid zinc under special conditions of pressure and temperature. Faulty chemical conditions are such that from the vapor not merely zinc but something else is condensed. When a certain limit of carbon dioxide in the gas of the zinc retort is exceeded the carbon dioxide oxidizes the zinc, coats the condensing globules of zinc, prevents coalescence and forms a powder. Many impurities in the ore under treatment will act in the same way. For instance, if the ore contains silica and an arc furnace is employed, silica or silicon vapors will be formed, and in condensation each condensing globule of zinc will be coated with a fine layer of silica and the coated globules will not run together and form liquid zinc, just in the same way as it is impossible to run globules of mercury coated with flour together into a liquid mass of mercury.—*Met. and Chem. Eng'ing*, August, 1912.

Electric-Furnace Pig-Iron.—D. A. LYON AND F. C. LANGENBERG.—An article illustrated by microphotographs on a microscopic study of pig-iron reduced from iron ore in the plant of the Noble Electric Steel Company in Shasta County, Cal.—*Met. and Chem. Eng'ing*, August, 1912.

Simultaneous Electrolytic Deposition of Copper and Zinc from Various Solutions Not Containing Cyanide.—M. DE KAY THOMPSON.—An account of an experimental investigation in which eleven complex copper salts were made by the following agents and were electrolyzed after mixing with zinc sulphate solution: Glycerine, cane sugar, tartaric acid, glycocoll, sodium potassium tartrate and sodium hydrate, thiosulphate, phosphorous acid, ammonia, thioglycollate, oxalate and sodium pyrophosphate. The only solution which gave a smooth, bright deposit when electrolyzed for an hour or more was the alkaline sodium potassium tartrate solution. This deposit, however, had a bronze color. The solutions from which appreciable amounts of zinc were deposited with copper were the alkaline potassium sodium tartrate, the oxalate and the pyrophosphate. It was not found in any case that diminishing the total amount of copper in the solution improved the deposits. It seems that the complexity of the copper salt must be relied on to reduce the concentration of the ions sufficiently, while there must be enough copper present in the unionized state to furnish ions as rapidly as they are used up.—*Met. and Chem. Eng'ing*, August, 1912.

Units, Measurements and Instruments.

The Shape of Scales Required for Reflecting Instruments with Concave Mirrors.—E. H. RAYNER.—A paper read before the Optical Convention in London, with reference to the arrangements adopted in the (British) National

Physical Laboratory for the precision apparatus for alternating-current measurements. A concave mirror is employed, and a real image of an artificial source of light is projected on to a translucent or opaque white scale on which suitable marks are drawn. A Nernst lamp and a condensing lens with a fine vertical wire in front of it form a suitable source of light, producing on the scale a circular bright spot with a fine line across the vertical diameter. The paper deals with the shape of the scale required in order to have the vertical wire always sharply in focus while the concave mirror rotates about a vertical axis. If the angular deflection be only a few degrees, a straight scale is commonly used, but it becomes unsatisfactory if the deflection is considerable. Neither does a circular scale with the mirror at the center sufficiently approximate to the proper curve for instruments reading by a reflected ray of light whose working deflecion may reach 120 deg. The scale has to approach continually the mirror as the angle of incidence increases, and for deflections of 90 deg. from the incident ray the distance may be reduced to one-half. The theory of the arrangement is briefly explained and the results are given in the form of a diagram and a table.—London *Elec. Review,* July 19, 1912.

Bureau of Standards.—G. K. Burgess.—An account of the scope of the work of the Bureau of Standards in the fields of metallography and metallurgy.—*Met. and Chem. Eng'ing,* August, 1912.

Telegraphy, Telephony and Signals.

Submarine Telegraph Cable.—H. W. Malcolm.—A continuation of his long mathematical serial, illustrated by numerous diagrams, on the theory of submarine telegraph cables. In the present instalment the phenomena at the sending end are discussed, both sending current and voltage being dealt with. The author first takes up an infinitely long cable and then a finite cable without end apparatus. The serial is to be continued.—London *Electrician,* July 19, 1912.

High-Frequency Alternator for Wireless Telegraphy and Telephony.—An illustrated article on the Goldschmidt high-frequency alternator, which is based upon the induction of currents of higher and higher frequency by "reflection." The experimental station at Slough is equipped with an

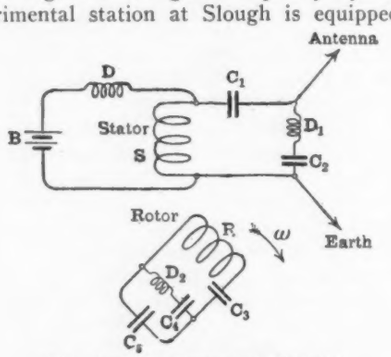


Fig. 2—Arrangement of Circuits.

antenna of enormous spread in order to be able to deal with the long waves (5000 m) employed, but otherwise it presents no special feature. The apparatus inside the building comprises a Goldschmidt alternator capable of giving an output of 9 kw at 60,000 cycles per second, although 12 kw has been obtained from it at a lower frequency. The alternator is driven by a direct-current motor through a step-up gear. The peripheral speed of the rotor is about 150 m per second, at which velocity the frequency generated in the rotor is 15,000 cycles per second. By reflection these currents induce others with a frequency of 30,000 cycles in the stator, which again induce currents of 45,000 cycles in a circuit (containing suitable capacity) shunting the rotor. The currents again set up others with a frequency of 60,000 cycles in a circuit connected to the stator. The arrangement of these circuits can be seen in Fig. 2, in which circuit C_4D_2 has currents of frequency 15,000 in it, C_2D_1 those of 30,000 frequency, C_5 is resonant to 45,000 cycles, and, finally, pure 60,000-cycle currents can be taken off from the points where the antenna and earth are shown connected. Excitation is effected by means of continuous current, in the present case from storage cells. For gradually varying the wave-length induction coils and condensers are provided.—London *Electrician,* July 19, 1912.

Miscellaneous.

Characteristic of an Artificial Insulating Material.—E. Knoblauch.—An illustrated translation in abstract of his recent German paper on a graphical method for giving the principal properties of a series of artificial insulating materials in a diagram.—London *Electrician,* July 19, 1912.

"The Point Fives."—An article on the first meeting of a new electrical club in London, the qualification for membership being that the engineer—whether of a company or a municipal station—shall be selling energy at the rate of ½d. (1 cent) per kw-hr. for domestic cooking, or for cooking and heating.—London *Electrician,* July 19 1912.

Book Review

Ornamental Street Lighting. Compiled by committee on electric advertising and ornamental street lighting of the National Electric Light Association, William H. Hodge, Chicago, chairman. Arranged by Waldemar Kaempffert. New York: National Electric Light Association, Commercial Section, 29 West Thirty-ninth Street. 48 pages, 21 illus. Price, 30 cents; in quantities, 20 cents.

The aim to provide for the non-technical citizen or civic body a compilation of arguments and facts concerning ornamental street lighting has been splendidly attained in this handsomely executed booklet, which is offered to the industry at a nominal price. Between its gold-embossed covers of heavy brown paper are contained detailed information of numerous existing installations, discussions of the advantages of ornamental lighting, descriptions of methods of construction, types of poles, etc., together with lists of the cities where each type of lighting may be inspected and the names of manufacturers of street-lighting fixtures and supplies. Perhaps the best idea of the text-matter of the booklet is afforded by its topics as indexed with sub-titles—"The Business Side of Side Street Lighting—the Money Value of a Great White Way"; "Municipal Lighting, Right and Wrong—Light Is Made to See By, Not to Look At"; "How Business Sections Should Be Lighted"; "How Residential Sections Should Be Lighted"; "How Electric Signs and Window Lighting Affect the Street—Sign Lighting Advertises a Thing Far and Wide; Window Lighting Attracts the Passer-by; Street Lighting Arouses the Talk of a Whole Country"; "What It Costs to Light a Street—Dollars and Cents." The last-mentioned chapter is perhaps the only one in the book which seems inadequate, since but a single average example is stated, conditions and data are missing, and the figures named for installation cost appear to be higher than those for which many installations have been made in this country. All types of incandescent and arc installations are shown, while an addendum presents details of each type of post, including combination fixtures. In the closing pages the cities which have ornamental lighting systems are listed—"three hundred cities that have found every dollar invested in an ornamental lighting system for business sections, residential districts and parks is returned many-fold, not only in higher real estate values and greater prosperity, but returned in prestige, in heightened civic pride and in better citizenship." Other lists give the names and addresses of manufacturers of ornamental standards, transformers, regulators and compensating apparatus, glassware, steel reflectors and incandescent lamps.

New Apparatus and Appliances

GRIP NIPPLE FOR CONDUIT WORK.

In order to provide a cheaper system than the usual form of screw junction, several means of rendering ordinary unscrewed conduit electrically continuous have been devised abroad. Of these various methods one of the first was the Simplex grip nipple of the Simplex Conduits, Ltd., London, England. This nipple was cut out of a solid hexagonal steel bar, and its successful application to all classes of installations has led the company to develop this form of nipple with a view of reducing the cost without affecting the efficiency of the device or the ease with which it might be applied. A modification of the hexagon nipple is now being introduced in which the hexagon head is replaced by a milled head. The adoption of the milled-type nipple

Couplings.

results in a material cost saving. It might be mentioned in this connection that in the Simplex system it is necessary in erecting to remove the enamel from the end of the conduit for a distance approximately equal to its diameter. This cleaned end must be entered into the contact nipple, which is screwed hand tight into the fitting. The contact nipple is then tightened and, acting as a screwed wedge, firmly fixes it in position and establishes continuity.

SUBMERSIBLE MOTORS.

The usefulness of a submersible motor was recently illustrated by the Submersible & J-L Motors, Ltd., Southall, Middlesex, England. A sunken 100-ton barge, resting on the river bed with its sides just above the water, was raised in thirty minutes by means of a 10-hp, 220-volt motor directly connected to a centrifugal pump, rated at 600 gal. per min. at a speed of 950 r.p.m The motor and

Submersible Motor.

pump were sunk into the barge by means of a crane. It had no suction pipe, and an ordinary pipe which happened to be at hand was used for the delivery pipe.

The value of a motor not affected by the humidity of its surroundings is inestimable in many kinds of work, for instance, mining and on board ship. It may be coupled to a compressor in any part of a mine, and air pipes may be run to distant parts. A switch operated from the pithead will cause the pump to deliver the air although both motor and compressor may be many feet under water. The danger of explosion is removed as the motor is thoroughly inclosed.

A further function of the motor lies in combating the influx of water into ships in the event of accidents, particularly if a motor pump is placed in each of the main compartments of the vessel.

ATTACHMENT FOR PULL SOCKETS.

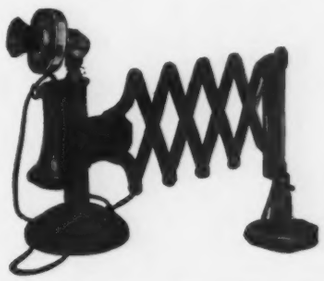
An attachment for pull sockets developed for the market by Harvey Hubbell, Inc., Bridgeport, Conn., is arranged to be joined to the lamp socket and not to the shade holder. A pull on the cord produces an even, firm pull on the chain, which is drawn directly forward without dragging on the edge of the chain guide. The end of the chain rides in a groove in the rocker, which maintains even tension at

Attachment for Pull Sockets.

every degree of operation. It is claimed that the responsiveness of the device to a slight pull on the operating cord makes it the most satisfactory attachment thus far developed.

FOLDING TELEPHONE TRANSMITTER ARM.

A telephone transmitter arm recently developed by the Western Electric Company is of the folding or "ferry-gate"



Folding Telephone Transmitter Arm.

type. It is built in three different styles, to be placed on top of a flat-top desk, on the wall or the side of a flat-top desk, or on the side of a roll-top desk. The arrangement is such that the arm may be used with any desk telephone by means of a clamping device at the end farthest from the pedestal.

INTERCHANGEABLE LIGHTING FIXTURE.

A recent development in lighting fixtures which attracted considerable attention at the recent Denver convention of the National Electrical Contractors' Association is shown in the accompanying illustrations. The fixture, which has been designed for indoor use, combines the advantages of ready take-down and assemblage without danger of injury to the wires. It consists of a body, a stem and canopy, with arms attached to the body and fittings by bayonet joints and screws. When folded ready for shipment the fixture is placed in a box only 7 in. square. The fixture is assembled in place by using merely a screwdriver and a pair of pliers.

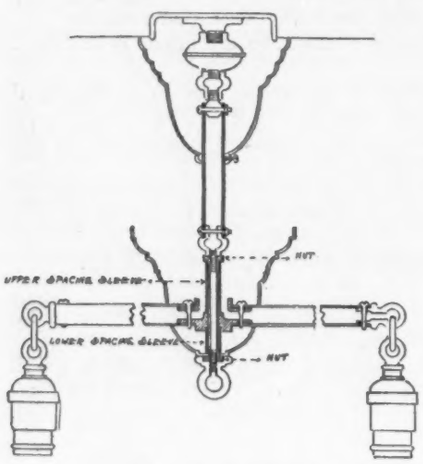


Fig. 1—Details of Interchangeable Fixture.

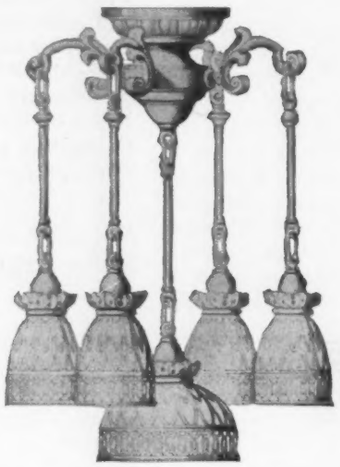


Fig. 2—Fixture with Direct Lighting Units.

Fig. 3—Fixture with Indirect Lighting Units.

The center rod, spacing sleeves and bottom knob lock the parts into position. The arms are brought snugly against the shoulders and the screws can then be quickly set into place. A similar arrangement is used for attaching the arms and fittings. Where the pins pass through the wireways the screw thread is omitted, thereby minimizing the difficulty in inserting the wires and eliminating the chance of bringing about injury to the insulation by screwing in the arms.

All of the connecting parts are interchangeable, it being claimed that any fixture may be altered in design within five minutes. Having on hand a few bodies, several styles of arms and end fittings, any combination may readily be made into a completed fixture in accordance with the particular wishes of the customer.

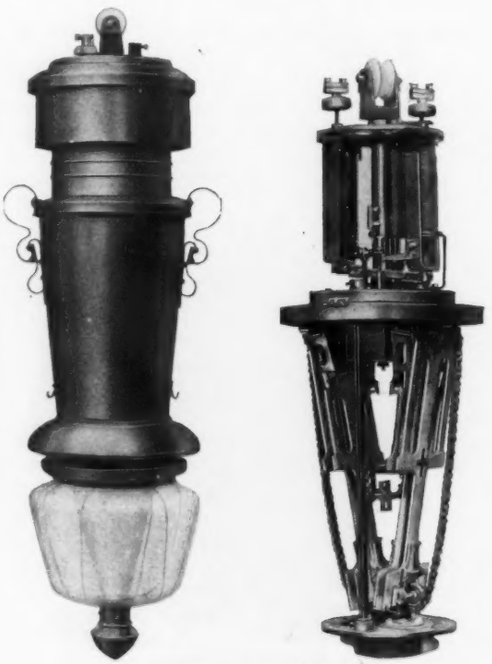
The above-described fixture has been placed on the market by the Albert Sechrist Manufacturing Company, Denver, Col.

LONG-BURNING FLAME-ARC LAMP.

In general construction the lamp illustrated herewith embodies a main and shunt solenoid which operates the two magazines containing the electrodes. This is effected by means of a special toggle, which permits great delicacy of movement when the magazines are near each other, so that, however heavy or stiff the magazines may be, the feed remains reliable.

The non-extinction is secured by arranging that before one pair of electrodes has ceased to burn another pair comes into contact. The arc is therefore at once formed between the new pair and at the same time disappears from between the ends of the old pair. This process is effected by dividing both the positive and negative magazines into two separate compartments having an endless chain passing down between the two sets of electrodes. The chains are driven simultaneously by a simple ratchet, actuated by the falling weight of a small shunt solenoid core, the circuit of which is completed by the action of the differential regulating coils when the voltage across the arc slightly increases. The feed produced by this arrangement is said to be almost imperceptible, and the light, therefore, is steady and constant. A cut-out with self-aligning contacts is also provided in the lamp, which puts in a substitutional resistance of ample proportions, it being impossible for the arc and resistance to remain in parallel, as the contact must be broken before the carbons even begin to separate.

The mechanism is effectively protected from deposits and interference, and the magazine chamber is so constructed that practically no cleaning is necessary. The globe carrier is well ventilated and baffled and the case is substantially made and perfectly weatherproof. The lamp is fitted with diffusing globes, which distribute the light uniformly over a large area.



Long-Burning Flaming-Arc Lamp.

This lamp is manufactured by Johnson & Phillips, Ltd., Victoria Works, Charlton, S. O. Kent, England.

INDIRECT LIGHTING BY ARC LAMPS.

An arc lamp equipped for indirect lighting has recently been placed on the market by the Armorduct Manufacturing Company, Ltd., London, England.

It comprises a long-burning white-arc lamp taking from 5 amp to 6 amp and giving about 700 mean hemispherical

Arc Lamp Arranged for Indirect Lighting.

cp and a 27.5-in. enameled iron reflector attached to the lower part of the case. An inner glass globe is provided to keep the reflecting surface free from dust and the case is finished in white enamel. With a single pair of 13-mm carbon electrodes the lamp will run for upward of 200 hours at one trimming, and the makers claim that electrode renewals rarely exceed 25 cents per annum. The series coil is wound with bare aluminum wire, insulated by an oxidizing process, while the shunt coil is energized by a current of 2 amp. As there is no wandering of the arc, which is kept perfectly steady by the inclosed gases, an unusually effective distribution of light is obtained in consequence of the better reflecting surface of the top electrode, and because the light is not obscured by the bottom electrode as it would be if the arc traveled round the edge of the electrodes. The lamp is made for direct-current and alternating-current circuits and for single burning on voltages between 100 and 250, or for series burning on direct-current circuits at from 200 volts to 550 volts.

SILENT-CHAIN TRANSMISSION IN RUBBER MILL.

By W. E. Meadwell.

The process of rubber manufacture consists in general of washing the gum, mixing, compounding, calendering, forming or molding to shape, and curing. Practically all of the work is done by rolls of various sizes and arrangement. The service, especially when washing or mixing new gum, is very severe, the load often varying from 25 per cent to 150 per cent of normal in a few seconds. Gearing has mostly been used for this service heretofore, while the smooth-running, high-efficiency, silent-chain transmission is said now to have the preference.

The Mechanical Rubber Company's Works at Cleveland, Ohio, are equipped throughout with this kind of transmission, and two illustrations from this installation are shown as representative of many others that are being installed. Fig. 1 shows a mixer, which with others on the same shaft is driven by a 200-hp constant-speed induction motor. The double chain of this particular mill is of the Morse silent "rocker-joint" type, 10 in. wide, 1.5-in. pitch, with a speed of 1250 ft. per minute at the highest motor speed. The sprockets have 23 and 117 teeth, with speeds of from 435 to 85 r.p.m. and are set at 84-in. centers.

The drive on these machines is subjected to very severe service owing to the uneven load due to the rubber being run through the rolls in bunches or lumps, yet it has given more satisfactory service than gearing. The chains show no bad effects nor have any repairs been necessary.

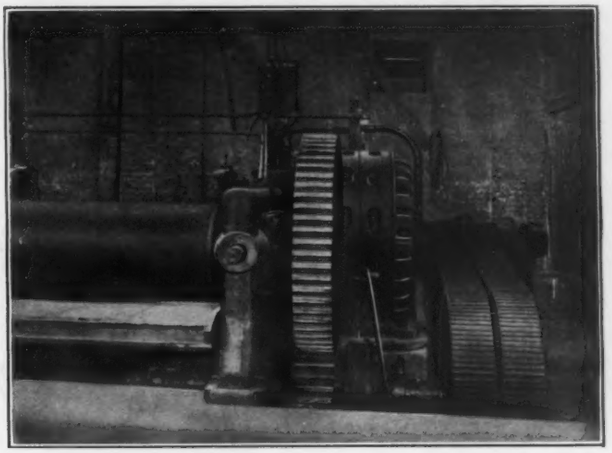


Fig. 1—Silent-Chain Drive for Rubber Mixer.

Fig. 2 shows, in the foreground, one of a battery of four roll rubber calenders, each driven by a Morse silent chain from a 75-hp four-speed induction motor. The chain is 1.2 in. pitch by 9 in. wide and has sprockets of 21 and 105 teeth, with speeds of 690 r.p.m. to 138 r.p.m. being set at 54-in. centers. Three-roll calenders are similarly driven.

These calenders are for making friction cloth and rolling out sheet rubber. While the load is more even than on the mills or mixers, the frequent stoppings, changes from one speed to another, etc., would work hardships upon a chain or other drive. There have been no repairs of any kind to these calender chains since their installation.

There are two sources of energy supply available at this plant, and by using a drum-type controller the different windings of the calender motors are thrown alternately on the two circuits and speeds of 255, 345, 510, and 690 r.p.m. are thereby obtained. Any of these speeds may be used for continuous operation. The fact that there have been no repairs to the chain drives since their installation shows their

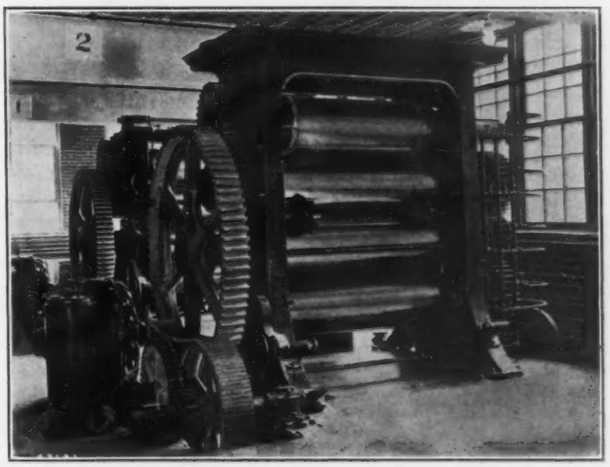
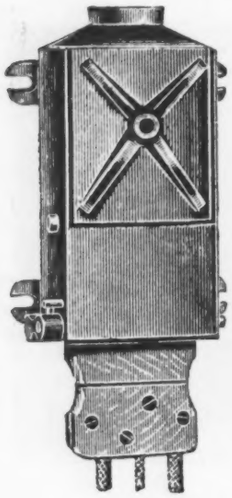


Fig. 2—Silent-Chain Drive for Rubber Calenders.

superiority over the old form of drive. The Morse Chain Company, Ithaca, N. Y., installed the silent-chain transmission in this rubber mill, and the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., furnished the electrical equipment.

WATERPROOF WALL PLUG.

A waterproof wall plug designed to suit the insurance requirements of England has been put on the market by the General Electric Company, Ltd., London, England.



Waterproof Wall Plug.

The plug is made in sizes ranging from 5 amp to 100 amp and is constructed to withstand the rough usage which such apparatus meets in docks, railway sidings and workshops. Impregnated hard wood is used for insulation, and the knife-blade contacts are self-aligning. A terminal is provided in the plug for a ground wire, while an aperture permits inspection on the point where the ground wire enters its terminal, as required by English rules. An automatic grip catch prevents the plug from accidentally dropping out, and when the plug is withdrawn a spring cover keeps the dust out of the socket.

POWER-FACTOR METERS.

The direct-reading power-factor meters manufactured by the Westinghouse Electric & Manufacturing Company operate on the rotating-field principle. The rotating field is produced by the current of the metered circuit passing through angularly placed coils, and in the field is situated a pivoted iron vane or armature magnetized by a coil whose current is in phase with the voltage of one phase of the circuit. As the iron vane is attracted or repelled by the rotating field of the current coils, it will take up a position where the zero of the rotating field occurs at the same instant as the zero of its own field. Thus the pointer indicates the phase angle between the voltage and current of the circuit, and by marking on the scale the cosine of the angle shown by the graduation the power-factor is read directly. In the three-phase meter the rotating field is produced by three current coils spaced 60 deg. apart; in the two-phase meter it is produced by two current coils spaced 90 deg.; in the single-phase meter the position of voltage and current coils is interchanged and the rotating field is produced by means of a split-phase winding.

In Fig. 2 the winding shown within the iron ring is the stationary winding of the current coils. Inside this and not shown are the stationary voltage winding and the pivoted armature. The laminated iron ring surrounding the winding is provided as a return circuit for the flux of the pivoted armature, so that the reluctance of the armature magnetic circuit is low and uniform in all positions.

The aluminum damping disk shown at the front of the meter moves in the concentrated field of the two permanent magnets at the bottom of the mechanism. These magnets and disk have no effect whatever on the electrical operation of the meter, but serve to prevent oscillations of the pointer. It will be noted that no connection is required between the fixed and the moving elements, nor is any control spring necessary, as the controlling force is electromagnetic. The moving element is, therefore, very light and the friction and bearing-jewel wear a minimum.

All the Westinghouse switchboard types and the polyphase portable types are arranged to read for lagging or leading power-factor on the upper half of the scale and for

Fig. 1—Power-Factor Meter.

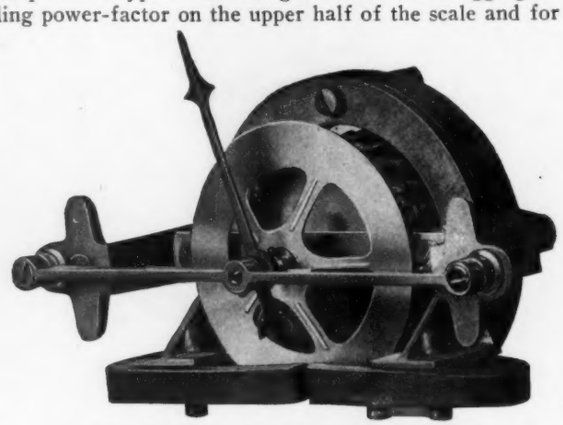


Fig. 2—Movement of Power-Factor Meter.

reversed power on the lower half. The switchboard types are adjusted for one standard frequency; the polyphase portable types are adjusted to any frequency between 25 and 60 cycles; the single-phase portable types indicate for 60 cycles on one-half the scale and for 25 cycles on the other half. The portable meters are convenient for investigating the power-factor of motor loads where it is desired to improve the operation of an alternating-current distribution and generating system.

MAXIMUM-DEMAND WATTMETER.

The instrument here illustrated was designed to meet the growing demand for a cheap and accurate device capable of indicating the maximum demand for power. The instruments now on the market are objectionable because they involve a special mechanism in addition to the regular watt-hour meter, the price of which prohibits their general use. In order to secure the necessary time element use is made of some special time-keeping device such as a clock or constant running motor, contact-making commutators, punch or printing mechanism, tapes, etc., all of which require so much attention as to limit their use to special cases.

The instrument here shown differs from previous devices in that all mechanism directly attachable to gear the train of the regular watt-hour meter has been abandoned. Advantage is taken of the fact that the air-gap of all commercial types of watt-hour meter will permit the introduction of a second or auxiliary disk into the magnetic field of the main-meter element, giving ample clearance between disks and magnet poles. The torque developed in the second disk is at all times equal to that of the original disk and thus forms the basic element of an indicating wattmeter. The rate of deflection of the second or auxiliary disk is controlled by a slightly modified form of escapement such as is used in a watch, the difference being that the torque of the auxiliary disk plays the part of the mainspring while the revolving meter disk performs the function of the balance wheel.

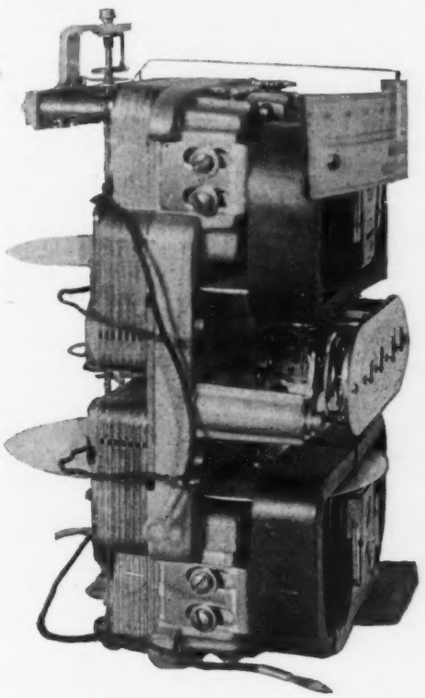
The complete instrument is thus a combination watt-hour meter and indicating wattmeter with a time element capable

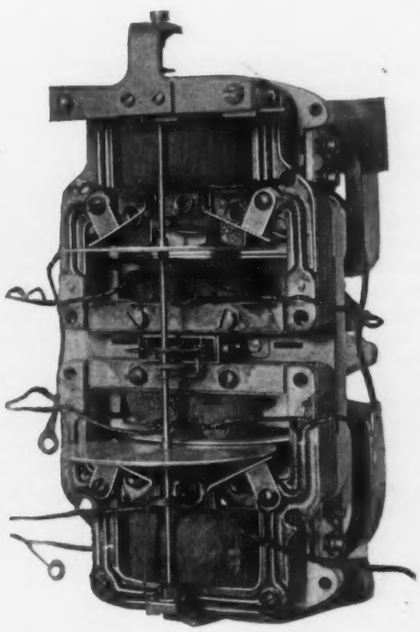
of being varied to suit any desired condition, the whole being inclosed in a case only slightly larger than that of the original watt-hour meter, thus avoiding the expense and space necessary to the installation of the auxiliary apparatus used with the present types of instrument. The maximum load is indicated on a scale similar to that of an edgewise wattmeter. The indicator is set back to zero at the end of any desired period by raising a latch on the outside of the case, the latch being sealed after each operation. The price of the complete instrument will be from 25 per cent to 50 per cent above that of the original watt-hour meter.

The operation is as follows: The instant power is drawn through the meter a shunt coil drives a flux from the lower pole across the air-gap to the upper poles, thus inducing eddy currents in both disks, which are acted upon by the flux from a series coil, producing an equal torque in both disks. The watt-hour-meter disk, being free, begins to revolve immediately, thus causing an escapement claw to oscillate and also driving the regular registering device. This auxiliary disk also tends to rotate but engages the teeth of a ratchet wheel, thus driving an escapement wheel, the teeth of which are allowed to pass slowly, one at a time, by the above-mentioned escapement claw. A lever connected to the auxiliary shaft drives the indicator or pointer over its scale. This movement continues at a rate determined by the speed of the main meter disk until the combined tension of two hairsprings mounted at top and bottom of the shaft equals the torque developed in the auxiliary disk when the instrument is in equilibrium. The integrating device, of course, continues to operate in the usual manner. The position of maximum deflection is indicated by a pall acting on the ratchet wheel. When the load diminishes or is interrupted the auxiliary disk rotates back to a position of equilibrium under the action of the lower hairspring. The time of deflection from zero to any point of equilibrium is constant since the deflection and speed of the main-meter disk vary in direct proportion. This time can be varied to suit any condition by changing the gear ratio.

The device as applied to a standard polyphase watt-hour meter is shown in Figs. 1 and 2. Fig. 2 gives the rear view showing the auxiliary disks, upper and lower bearings, ratchet wheel and gear box located in the space between the upper and lower meter elements. Fig. 1 shows the indicator, small hairspring, fine-toothed ratchet wheel and trip lever. The pin is shown on the main meter shaft, which actuates the forked escapement lever projecting from the gear box through a hole cut in the casting of the original meter. The scale is calibrated in hecta-watts.

This meter has been developed by Mr. C. A. Boddie, 116 Grove Avenue, Winthrop Highlands, Mass.





Figs. 1 and 2—Side View and Rear View of Maximum-Demand Meter.

SEMI-INDIRECT LIGHTING UNIT.

In the illumination of hospital wards and private rooms a type of lighting unit should be used the glare from which can cause no possible annoyance to the patient who must lie on his back and look directly at the light source. Some form of semi-indirect lighting unit might be expected to give the best results, but where a board of directors, for example, hands down the final decision in regard to the lighting system the question of first cost and outlay for maintenance is apt to determine largely whether or not the patient will have added to his suffering the effects of a poorly selected lighting unit.

Semi-Indirect Lighting Unit.

To meet such requirements, the semi-indirect unit here shown, combining high efficiency, moderate first cost and ease of maintenance, has recently been placed on the market. The lamp is a 100-watt clear-bulb tungsten unit, and the holder consists of a sleeve which fits over the regular socket and is connected by two brass strips to a circular spinning. This fits in the collar of the reflector and is secured by a cap and small nut on the outside, making it easy to remove the reflector for cleaning without removing the lamp. The reflector is a Haskins Lucida, Mission Bell type, and the unit, by photometric test, is reported to show an efficiency of about 87 per cent, 30 per cent of the total lumens of the lamp being transmitted below the horizontal. This unit has been placed on the market by the Haskins Glass Company, Chicago, Ill.

Industrial and Financial News

BROADER demand from all parts of the country for all of the leading commodities, an increase of nearly 8 per cent in the country's bank clearings in July over those in July, 1911, better collections, higher money rates and certainty of excellent crops are the significant signs of progress in the trade situation this week. Large orders and inquiries for railroad equipment, shortage of labor reported here and there, the fact that uncertain delivery is becoming the principal obstacle to the placing of new steel contracts, and mild revival of activity in the stock markets, are other signs that expansion is taking place. Salesmen on the road are doing well as a result of the good crop prospects. Earnings of public-utility companies continue to show marked gains, the manufacturers of electrical equipment are enjoying good business, lighting and traction companies are extending their systems, new companies are being formed at an encouraging rate, and the entire electrical industry continues to reflect a high degree of prosperity and progressiveness. Taken as a whole, the trade situation has shown marked improvement since the beginning of the present month, and the industrial outlook is exceedingly bright. Money rates are advancing in response to trade activity, an indication in itself that expansion is taking place. Quotations in New York Aug. 7 were: Call, 2¼@3; ninety days, 3¼@4.

Copper Production in 1911.—A special statement relating to metal production in this country in 1911, issued this week by the United States Geological Survey, shows that while the copper output from many of the leading copper-producing states last year was below normal, this falling off was offset by larger outputs from other states. According to this statement, while copper in Colorado is of subordinate importance to gold, silver, lead and zinc, the total recovered copper from Colorado ores in 1911 had a gross value of $1,003,061. This represents a decrease of $58,600 in value as compared with the 1910 output. Copper production in Colorado was reported from twenty-one counties in 1911, and of these Lake, San Miguel, Gilpin, Clear Creek, Ouray and San Juan Counties, in the order named, were the principal producers, the first named furnishing 4,017,504 lb. out of a total of 8,024,488, or practically 50 per cent. The copper output of New Mexico was 4,057,040 lb., of which 97 per cent, or 3,918,928 lb., came from Grant County. The output from the latter was 485,466 lb. less than in 1910, and the total output of copper in the State showed a decrease of $78,897 in value. Copper production increased in Nevada from 64,359,398 lb., valued at $8,173,643, in 1910, to 67,377,518 lb., valued at $8,422,190, in 1911. The increase was practically due to the mines at Ely, in White Pine County, which yielded 67,033,547 lb., or 99.49 per cent of the entire state production. The production of copper in Montana decreased from 284,808,553 lb. in 1910 to 272,847,705 lb. in 1911, a decline of 11,960,848 lb. The Summit Valley or Butte district contributed all but 589,253 lb. of the total. Arizona remained the leading copper-producing state, increasing its production from 297,491,151 lb., valued at $37,781,376, in 1910, to 306,141,538 lb., valued at $38,267,692, in 1911, a gain of 8,650,387 lb. The figures given for Utah show that copper production in that State increased from 127,597,072 lb. in 1910 to 146,960,827 lb. in 1911, an increase of 19,363,755 lb. The production of copper in Idaho decreased from 7,037,292 lb., valued at $893,736, in 1910, to 5,152,937 lb., valued at $644,117, in 1911.

May Put Westinghouse Electric Common on 6 Per Cent Basis.—Numerous reports to the effect that the present financial condition of the Westinghouse Electric & Manufacturing Company will result in establishing the common stock on a 6 per cent per annum basis when the directors meet in September have been in circulation in the financial districts of late. In view of the facts that the company's earnings are now running at the rate of 15 per cent per annum on the common stock and that the foreign Westinghouse companies are now in a sound condition, there seems to be reasonable justification for these rumors. Aside from a 1 per cent dividend paid last March no disbursements have been made to common stockholders since 1907. Dividends have been paid by the company in the past as follows: On the preferred, 1892 to May, 1903, at the rate of 7 per cent per annum; in July, 1903, 2⅛ per cent; from September, 1903, to October, 1907, inclusive, at the rate of 10 per cent annually. On October 15, 1909, dividends were resumed on the preferred stock at the rate of 7 per cent per annum, and the back dividends to that time, amounting to 12¼ per cent, were paid off, together with the regular quarterly dividends, as follows: On Oct. 15, 1909, Oct. 15, 1910, and Jan. 16, 1911, 3½ per cent; on April 15, 1911, 1¾ per cent. The first dividend on "assenting" stock was paid Feb. 20, 1900, the rate being 5 per cent per annum; from then until May 15, 1903, the rate was 7 per cent. Between July, 1903, and October, 1907, inclusive, dividends of 10 per cent per annum were paid. None, excepting the 1 per cent declared March 27, 1912, as above, has been paid since 1907. The company now has 20,000 men at work at its East Pittsburgh plant, which is 3000 more than at any other time.

Western Electric Gives Up Its Wiring and Construction Business.—On July 27 the Western Electric Company discontinued its electric-light wiring and construction department, which had been successfully engaged in the installation of all kinds of electrical equipment for lighting and motor-service purposes for over twenty years. The company has taken this step evidently in the belief that it will improve its relations with and more adequately serve the supply and contracting trade by devoting itself exclusively to the supply end of the business. Among the prominent buildings in which the entire electrical installation was made by this department are the United Engineering Societies Building and the Engineers' Club, the Waldorf-Astoria, St. Regis, Astor, Belmont and Ritz-Carlton Hotels, New York; the Carnegie Library and the Oliver Building, Pittsburgh; the St. Louis Public Library, and the Hotel Stadtler, in Cleveland. Upon termination of this department Mr. E. S. Keefer, who was instrumental in its formation and who has been manager of it throughout its successful career, was appointed a special representative of the Western Electric Company, in which capacity he will cooperate with the managers and sales managers of the company's branch houses in attracting further patronage from the contracting and supply trade.

Changes Coming in Board of Columbia Gas & Electric Company of Ohio.—According to representatives of A. B. Leach & Company, a reorganization will take place within the next few weeks of the board of directors of the Columbia Gas & Electric Company, of Cincinnati, which, as noted in these columns July 20, was recently purchased by a syndicate headed by A. B. Leach & Company and J. & W. Seligman & Company, of New York. Norman G. Kenan, Charles H. Davis, N. S. Keith and F. R. Williams, of the present board, have been asked to tender resignations. It is understood that Archibald S. White, president of the company, and Rollin W. White will also retire from the board. Mr. Kenan's retirement from the board of the Columbia Gas & Electric Company will be followed by his resignation as president of the Union Gas & Electric Company, of Cincinnati, which is a subsidiary of the Columbia company.

Pennsylvania Companies Merged.—The East Pennsylvania Gas & Electrical Company, of Bristol, Pa., was incorporated at Harrisburg, Pa., this week with a capital of $225,000 and a bonded indebtedness of $500,000, with Charles Campbell, of Bristol, as president. The new company is a consolidation of several small companies heretofore owned and operated by the Public Service Corporation of New Jersey. These are: The Bristol Gas Light Company; Yardley Electric Light, Heat & Power Company, and People's Gas Light & Fuel Company, of Bucks County. With sale of these companies the Public Service Corporation ceases to operate gas or electric properties outside of New Jersey.

Electrical Contractors Get Small Profits from New Building Work.—Speaking of conditions in the electrical contracting business in New York, the head of one of the largest concerns engaged in that line of work said this week that one of the main reasons, in his opinion, why the electrical contracting business is not as remunerative as it might be, and does not average as much profit per job as it has in the past, lies in the widespread growth of speculative methods in the building business. The practice of putting up cheaply constructed buildings merely to sell them quickly at a good profit has become so common, he said, that, excepting the few cases where a banking, insurance or similar institution puts up a building for its own use, the material used in the majority of office buildings is not all that it might be, nor is the electrical equipment specified, either in quality or amount, much more than barely adequate to satisfy the Underwriters and serve the tenants. Promoters of these ventures, he added, scale down the cost of every piece of equipment put in these buildings, to the detriment of the electrical contractor. Another outcome of this speculative and close-fisted policy, in his belief, is the wider use of central-station service in the city. The temporary owners, he explained, are not interested in the relative merits of isolated-plant and central-station service; they are merely interested in any method whereby they can avoid tying up capital. The introduction of central-station service in many of the new office buildings, he believes, is due to these conditions.

Federal Sign System Convention.—About fifty men, principally managers of district offices, attended the third annual convention of the Federal Sign System (Electric), which was held on July 31 and Aug. 1, 2 and 3 at the Moraine Hotel, Highland Park, Ill. John F. Gilchrist, treasurer of the company, presided, and a number of business sessions were held, at which papers of interest to the organization were read and discussed. An interesting feature of the convention was the first distribution of the capital stock of the company to managers under the stock-participating plan of the company, adopted two years ago. A banquet was held at the Moraine on the night of Aug. 2. John F. Gilchrist was toastmaster, and the first address was made by John H. Goehst, president of the company, who made the interesting announcement that for the year ended July 31, 1912, the company had done a business 50 per cent larger than in the preceding year. Other speeches were made by Samuel I. Levy, of Philadelphia, general auditor of the company, on "The Eastern District"; James M. Gilchrist, of Chicago, secretary, on "The Factory"; Herbert I. Markham, of Chicago, general manager, on "The Past and the Future," and O. B. Marsh, of Cincinnati, on "The Salesman."

Another Doherty Company to Be Formed.—In order to provide capital for a new holding corporation for gas and electric properties that is being organized by H. L. Doherty & Company, an issue of $2,000,000 6 per cent notes has been sold by the Gas Securities Company of New York, of which H. L. Doherty is president, to a syndicate of bankers. Details of the new company will be made public in the fall. Examinations of several gas and electric properties in the Middle West are being made with a view to purchase, but their names are naturally withheld at this time. The notes are convertible into subscriptions for the securities of the new company and the note holder will be guaranteed an allotment of preferred stock of the new company equal to the amount stated in the conversion clause of the notes. Or, if desired, cash will be paid for the notes on maturity, in case the holder does not wish to convert them into securities of the new company. The latter will be offered on a basis of par for the preferred stock, with a bonus of 40 per cent of common stock.

Oxford (N. Y.) Company to Issue Bonds.—The Public Service Commission for the Second District of New York has authorized the Oxford Electric Light Company to make a mortgage upon all its property to secure an issue of 5 per cent gold coupon bonds to the amount of $50,000. The company is authorized to issue at present bonds to the amount of $32,500, to be sold at not less than 85, of which $14,000 is to be used for the refunding of current liabilities and the reimbursement of the treasury for expenditures out of income; $7,750 for construction and equipment of transmission lines from Norwich to Oxford for the purpose of giving day and night service instead of service from sunset to sunrise as at present, and $5,500 for construction of a transmission line from Oxford to Guilford, a distance of 6 miles.

West Virginia Traction & Electric Corporation Organized.—Interests associated with the Electric Properties Company have organized the West Virginia Traction & Electric Corporation, which has taken over the Union Utilities Company, of Morgantown, W. Va., and the City & Elm Grove Railway Company, of Wheeling, W. Va., together with the Suburban Light & Power Company, a subsidiary of the last-named company. The newly organized corporation has a capitalization of $2,000,000 7 per cent preferred stock, of which $560,000 is outstanding, and an authorized issue of $2,000,000 common stock, of which $1,250,000 is outstanding. It also has an authorized issue of $25,000,000 5 per cent first, refunding and extension thirty-year bonds, of which $1,565,000 have been issued.

Northern Minnesota Power Company Financing.—An offering of $90,000 of its 6 per cent twenty-five-year bonds is being made by the Northern Minnesota Power Company, of Aurora, Minn. J. H. Simons, president of the company, says that the villages of Aurora, McKinley and Gilbert have contracted with the Northern Minnesota Power Company for a supply of energy for all village consumption purposes for a period of ten years, with an option of ten additional years, at 3½ cents per kw-hr. The company has also been granted a franchise to run transmission lines through Aurora for twenty-five years. Electric pumps for local water-supply purposes are to be installed at Aurora and McKinley.

West Penn Traction & Water Power Company Has Record Year.—The report of the West Penn Traction & Water Power Company for the year ended June 30, 1912, shows an increase in gross earnings of 28.7 per cent over the returns in the preceding year. This gain is one of the largest in the history of the company. Gross earnings were $2,666,294, as compared with $2,260,286 in 1911 and with $1,060,238 in 1905, when the first annual statement was made. Net earnings last year were $1,290,666, as compared with $1,148,005 in the year ended June 30, 1911, and with $480,480 in that ended June 30, 1905.

July Incorporation Figures.—Papers filed in the Eastern States in July for companies with an authorized capital of $1,000,000 and over represented $253,518,000, according to compilation by the *Journal of Commerce*, New York. This figure represents a decrease of $26,732,000 from June, and an increase of $57,668,000 as compared with July, 1910. Charters taken out by other companies with an individual capital of $100,000 and more, but under $1,000,000, including states other than those in the East, brought the grand total up to $332,094,000, against $393,948,000 in June and $261,820,700 in July a year ago.

Additions to Merchants' Heat & Light Company's Plant, Indianapolis.—The Merchants' Heat & Light Company of Indianapolis, Ind., according to E. Darrow, general manager, recently purchased from the Allis-Chalmers Company, Milwaukee, a 5000-kva turbo-generator, and from the Westinghouse Machine Company, Pittsburgh, a 1000-gal. turbine-driven boiler-feed pump, a Leblanc condenser and a 150-kw turbo-exciter set. This is the final requisition for the equipment originally mentioned in the *Electrical World* of March 30 last, page 710.

German Wireless Company to Operate in the Pacific.—Advices from Berlin state that the German South Sea Company has been formed there with a capital of $3,250,000 to furnish wireless connection between the various German possessions in the Pacific. High-power stations are to be built shortly in New Guinea, Samoa and the Caroline Islands, where the German-Dutch Telegraph Society has a cable station.

President Vetoes Bill to Dam White River in Arkansas.—A bill authorizing the Dixie Power Company to build a dam across the White River, near Cotter, Ark., was vetoed Aug. 6 by President Taft, on the grounds that the dam might affect development of the river and also that the bill contained provisions which are contrary to the water-power policy now being formulated by the National Waterways Commission.

National Electric Signaling Company's Affairs.—If the receivers appointed for the National Electric Signaling Company do not continue to operate this company, the Marconi Wireless Telegraph Company of America will be left as the sole occupant of the field in this country as far as commercial wireless activity is concerned. The National company, incorporated in New Jersey in 1902 with a capital stock of $100,000, controlled the patents and wireless-telegraph system invented by Reginald A. Fessenden. Its headquarters are at Pittsburgh, while an office is maintained at Camden, N. J., and a manufacturing plant at Brooklyn, N. Y. J. C. Baird is president of the company and T. H. Given is vice-president; Hay Walker, Jr., of Pittsburgh, is interested financially in the concern. The latter's chief assets are the patents and patent rights of Mr. Fessenden. It also has stations at Brant Rock and Boston, Mass.; at Watch Hill, R. I., and upon several Atlantic coast-line steamers. Differences between Mr. Fessenden and the company over patent matters and extensive litigation over patent rights are said to be the principal causes leading to the receivership. The value of quick assets is placed at $3,180. The liabilities are a judgment of $406,175 in favor of Mr. Fessenden, granted on May 13, 1912, and about $50,000 alleged advances made for the purpose of carrying on experimental work. These funds were advanced, it is understood, by Messrs. Walker and Given, and D. S. Walcott, a stockholder, on whose petition the receivers were appointed. It is also claimed that the company owes about $25,000 in salaries.

Central Colorado Power Company's Earnings.—The report of the Central Colorado Power Company, of Denver, Col., for the fiscal year ended June 30, 1911, shows gross revenues of $554,977, operating expenses of $209,308, and net earnings of $345,668, as compared with $424,979, $234,994 and $189,984 respectively in 1911. While net earnings have increased by $155,000, they are $255,000 under requirements for 5 per cent interest on the $12,500,000 bonded indebtedness of the company. President Walbridge states that new measures are necessary. Reduction of stock from $22,000,000 to $5,000,000 is said to be under contemplation. The company's principal field for sale of energy is in the Boulder and Leadville mining districts, to the Northern Colorado Power Company and the Denver Gas & Electric Light Company.

Takes New Jersey Commission Ruling to Courts.—The Interstate Telephone & Telegraph Company, of Trenton, N. J., brought suit last week in the New Jersey Supreme Court against the State Board of Public Utilities Commissioners to compel the latter to give it permission to issue $1,525,000 thirty-year first and refunding mortgage 5 per cent gold bonds, permission having been refused by the board on July 9. Justice Minturn, of the Supreme Court, has issued to the board an order, returnable Nov. 6, requiring it to show why a peremptory writ of mandamus should not be issued compelling it to grant the desired permission to the telephone company. The latter claims that it may be driven into insolvency if it cannot issue the bonds.

Wisconsin Commission Notes.—In order to enable the Portage (Wis.) Electric Light & Power Company to acquire the property and effects of the Portage Electric Company, the Wisconsin Railroad Commission has authorized the issuance of $75,000 6 per cent bonds and $35,000 of common stock. The commission has also authorized the La Crosse Telephone Company to issue $20,000 preferred stock at par, the proceeds from which are to be used in paying for a new switchboard, underground construction and the installation of new telephones.

Republic Railway & Light Makes Good Showing.—Consolidated earnings of the subsidiaries of the Republic Railway & Light Company, 60 Broadway, New York, for the year ended June 30, 1912, were $2,494,657, of which $994,142 was left as net earnings. After payment of interest charges, $463,857 was added to the surplus. These figures represent an increase of 8.37 per cent in gross, 7.45 in net and 13.57 in surplus.

Massachusetts Lighting Companies Gained Customers Last Year.—During the year ended June 30, 1912, a net gain of nearly 8.5 per cent in the number of its customers supplied with gas or electricity was made by the Massachusetts Lighting Companies. At the end of the year there were 26,413 customers, as compared with 24,388 at the close of the preceding year.

Garwood Electric Company's Property to Be Sold.—On Aug. 21 the property of the Garwood Electric Company, manufacturer of "C & C" dynamos, motors and appliances, will be sold at a receiver's sale at Garwood, N. J. Purchase of the property, which includes a manufacturing plant, materials, etc., will carry with it the right to use the name "C & C." There are some $90,000 of uncompleted contracts now on hand.

Tungstolier Company of Conneaut, Ohio, Purchased by General Electric Company.—The plant of the Tungstolier Company, manufacturer of a folding fixture, has been purchased by the General Electric Company. It has been located in Conneaut, Ohio, for seven years and employs 300 men. The old management will be continued with former President Kulas as general manager.

New Ohio Hydroelectric Company Formed.—The Sandusky River Power Company, with capital of $9,000,000, all subscribed, has been organized at Fremont, Ohio, with F. R. McMullin, of Chicago, as president. A force of 300 men is now engaged in the construction of a dam and power station on the Sandusky River, about 2 miles south of Fremont.

Summer Meeting of Bryan-Marsh Salesmen.—The salesmen of the Chicago district of the Bryan-Marsh Electric Works of General Electric Company, to the number of about twenty, assembled at Piney Ridge, on Hamlin Lake, near Ludington, Mich., last week for a week's convention and outing beginning on Aug. 4.

Large Louisiana Irrigation and Power Project.—Arrangements are being made for the formation of a fifteen-million-dollar corporation which will undertake extensive reclamation and power development work in southwestern Louisiana. New York capital, it is understood, is interested.

Chicago Telephone Company Enlarges Holdings.—The Northwestern Telephone Company of Indiana has been purchased by the Chicago Telephone Company. Negotiations are in progress for purchase of the Crown Point Telephone Company.

PRICES IN THE NEW YORK METAL MARKET

	July 30		Aug. 6	
Copper:				
Standard:	Bid.	Asked.	Bid.	Asked.
Spot	17.00	17.50	17.00	17.50
July	17.00	17.50	.....	.....
August	17.00	17.50	17.00	17.50
September	17.00	17.50	17.20	17.50
October	17.00	17.50	17.20	17.50
London quotation:	£ s d		£ s d	
Standard copper, spot	77 10 0		78 10 0	
Standard copper, futures	77 10 0		78 15 0	
Prime Lake	17.50 to 17.60		17.55 to 17.65	
Electrolytic	17.50 to 17.60		17.55 to 17.65	
Casting	17.25 to 17.30		17.30 to 17.35	
Copper wire, base	.....		19.00	
Lead	4.75		4.50	
Sheet zinc, f.o.b. smelter	8.75		8.75	
Spelter, spot	7.25		7.05	
Nickel	40.00 to 41.00		40.00 to 41.00	
Aluminum:				
No. 1 pure ingot	21½ to 22½		21½ to 22½	
Rods and wire, base	32		32	
Sheets, base	33½		33½	
OLD METALS.				
Heavy copper and wire	15.50		15.75	
Brass, heavy	10.00		10.00	
Brass, light	7.75		8.00	
Lead, heavy	4.40		4.15	
Zinc, scrap	5.65		5.75	

COPPER EXPORTS IN AUGUST

Total tons, including.....Aug. 6, 3,606

STOCK MARKET PRICES

	July 31.	Aug. 7.
Allis-Chalmers	1⅛*	1⅛*
Allis-Chalmers, pf.	4½*	4¾*
Amalgamated Copper	83⅛	83
Amer. Tel & Tel.	145⅞	146
Boston Edison	297	297½*
Commonwealth Edison	139	139½
Electric Storage Battery	55	56
General Electric	182	182
Mackay Companies	92¼*	90¼
Mackay Companies, pf.	69⅜*	69*
Philadelphia Electric	22¼	23⅛
Western Union	81¾	81½
Westinghouse	80	84¼
Westinghouse, pf.	121*	125*

*Last price quoted.

Personal

Mr. J. Sergeant Cram, of the Public Service Commission for the First New York District, sailed from New York on the *Lusitania* on Aug. 7, for a recreation trip in Europe.

Mr. Harry Hartwell has resigned his position as engineer for Sanderson & Porter, at Victoria, B. C., to become associated with the F. S. Pearson Engineering Company, New York.

Mr. J. Tachihara, electrical engineer of the Mitsu Bishi Company, Tokyo, Japan, who has been visiting this country for the past two months, sailed for his home from San Francisco on Aug. 3.

Mr. G. C. Ward, formerly president of the Huntington Land Company, has been elected first vice-president of the Pacific Light & Power Corporation, Los Angeles, to represent Mr. H. E. Huntington in the operation of the property.

Mr. Frank Lynch, who has been chief engineer of the Harrison Street station of the Commonwealth Edison Company of Chicago, has been appointed chief engineer of the new Northwest station, recently placed in service by that company.

Mr. H. S. G. Hurlbut has resigned his position as electrical engineer with the Esmeralda Power Company and the Tonopah Mining Company, Tonopah, Nev., to accept the position of superintendent of the Pacific Power Company at Jordan, Cal.

Mr. E. A. Burrill, vice-president and general manager of the Peoria Railway Terminal Company, Peoria, Ill., has resigned his position to become vice-president and general manager of the Northwestern Ohio Railway & Power Company, with headquarters at Toledo.

Mr. T. L. Sturgeon has been appointed manager of motor installations of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio. The company is completing a new generating station and expects to supply energy to a large industrial market; hence the need of a solicitor for motor load.

Mr. Paul Shoup, vice-president of the Pacific Electric Railway, Los Angeles, Cal., has been elected president of the company to succeed Mr. W. F. Herrin. Mr. Shoup was formerly assistant general manager of the Southern Pacific in charge of its electric railway lines in California. Mr. Herrin still remains vice-president and general counsel of the Southern Pacific company.

General George H. Harries, president of the Louisville Lighting Company and vice-president of the Consumers' Power Company, St. Paul, has been appointed general manager of the Minneapolis General Electric Company and all the united properties of H. M. Byllesby & Company in Minnesota. General Harries is president of the Association of Edison Illuminating Companies.

Mr. George Fisher has been appointed general superintendent of the Citizens' Light Company of La Salle, Ill., succeeding Mr. F. E. Brumagin. Mr. Fisher was formerly connected with the Danville (Ill.) Street Railway & Light Company in several capacities, serving at the time of his removal to La Salle as superintendent of the electric-lighting and steam-heating departments.

Prof. William Palmær, Ph.D., of the Royal Institute of Technology at Stockholm, Sweden, is at present in this country as the official Swedish delegate to the eighth international congress of applied chemistry. While in this country he will study educational methods in classes of electrochemistry at our colleges and will also visit a number of electrolytical works. Prof. Palmær is well known in Europe as the originator of an electrolytic process for producing from low-grade phosphates bicalcic phosphate for use as fertilizer. He has published a number of scientific papers, among which are "The Effect of Acids on Metals" and "The Absolute Electrolytical Potentials."

Mr. Norman B. Hickox, manager of the new-business department of the Muskogee Gas & Electric Company, Muskogee, Okla., has been made manager of the Greenwood Advertising Company at Knoxville, Tenn. Mr. Hickox has been at Muskogee during the past three years, during which time that city has gained an enviable reputation as one of the brightest and most thoroughly electrified cities of its size in the country. Before coming to Muskogee Mr. Hickox was associated with a syndicate headed by Mr. S. S. Bush, of Louisville, Ky. He will assume his new duties on Aug. 15.

Dr. C. E. Hiatt has resigned from the Westinghouse Lamp Company and entered the engineering department of the Commercial Research Company. He sailed with the president of the latter company, Mr. Byron E. Eldred, on the *Lusitania* on Aug. 7 to introduce the "Eldred" leading-in wires to the lamp manufacturers of Europe. Mr. Hiatt was Frazer Fellow in Physics at the University of Pennsylvania for two years and received the degree of Ph.D. in 1909. The following year he resigned the Harrison research fellowship to enter the physical engineering department of the Westinghouse Lamp Company. While with this company he conducted experiments in co-operation with the engineers of the Commercial Research Company which led to the adoption of the "Eldred" wire as a substitute for the solid platinum leading-in wires previously used. He is the inventor of a hysteretic frequency meter and two types of alternating-current-direct-current comparators.

Mr. Harry B. Ivers, who has recently been elected president of the Maine Electrical Association, is general manager of the Cumberland County Power & Light Company, which controls and operates the Portland Railroad, the Portland Electric Company, the Portland Light & Power Company and the Consolidated Electric Light Company. In addition, he is general manager of the Lewiston, Augusta & Waterville Street Railway, Lewiston, Maine. Mr. Ivers has long been connected with railway and lighting interests in New England, his experience dating from 1893, when he entered the employ of the Hyde Park (Mass.) Electric Light Company, under the management of Mr. Thomas F. Robinson. When the Robinson holdings were acquired by the Massachusetts Electric Companies Mr. Ivers assisted in consolidating the accounts and in operating the railways which were organized as a division of the Old Colony Street Railway. Mr. Ivers after that acted as superintendent of the West Roxbury division and was later transferred to Brockton. Subsequently he established his headquarters at Taunton. After being connected with these properties for nine years he was elected treasurer and manager of the Westerly (R. I.) Railway & Lighting Company, where he remained for four years. He then accepted the position of assistant to Mr. John R. Graham, president and general manager of the Bangor Railway & Electric Company, and a few months later was made treasurer of that company and of the Bar Harbor & Union River Power Company, which constructed the hydroelectric station upon the Union River at Ellsworth, Maine. About a year later the position of general manager of the Lewiston, Augusta & Waterville Street Railway was tendered to Mr. Ivers.

Obituary

Mr. Ziba Nickerson, one of the old-time telegraphers of New England, who was for fifty-five years manager of the Western Union office at Chatham, Mass., died at his home on Aug. 1 at the age of eighty-nine. He began as an operator in 1855, when the Brewster and Baldwin telegraph line was built on Cape Cod, and figured in the early attempts to communicate with Nantucket by cable. He retired from service at the age of eighty-eight.

Mr. William C. Fink, assistant treasurer and assistant secretary of the Bell Telephone Company of Pennsylvania, died suddenly on Aug. 4 at his home in Atlantic City, N. J. He was forty-nine years of age and had been in telephone work for the last twelve years. Mr. Fink was a prominent member of the Masonic order. Commencing as local manager at Lancaster, Pa., he was advanced in 1902 to the post of treasurer of the Pennsylvania Telephone Company at Harrisburg, Pa. Six years later, when that company was merged with other companies to form the Bell Telephone Company of Pennsylvania, he came to Philadelphia as assistant treasurer of the new company and afterward was made assistant secretary, both of which positions he held at the time of his death.

Construction

FLAT ROCK, ALA.—Plans are being prepared for the installation of an electric-light plant and water-works system here. Power for operating the system will be secured from the planing mill. Post office address, Fabius.

GADSDEN, ALA.—It is reported that the Alabama Pwr. Co. is soon to commence the construction of a large power plant at Lock 12 on the Coosa River, the ultimate capacity of which will be 42,000 hp.

LITTLE ROCK, ARK.—It is understood that the Little Rock Ry. & El. Co. expects to extend its lines, the City Council having passed an ordinance granting the necessary right-of-way.

ANTIOCH, CAL.—The proposition to issue $31,000 in bonds will be submitted to the voters at a special election to be held Sept. 21, of which the proceeds of $10,000 will be used for the installation of an automatic electric pump in the local electric plant.

DIXON, CAL.—Application has been made by the Great Western Pwr. Co. to the Board of Trustees for a franchise to erect transmission lines in Dixon. Bids for the sale of the franchise will be received until Sept. 10. J. F. Agee is clerk.

FAIRFIELD, CAL.—The Great Western Pwr. Co. has applied to the Board of Trustees for a franchise to erect transmission lines in Fairfield. Sealed bids for the sale of franchise will be received until Aug. 27. F. L. Morrill is clerk.

FRESNO, CAL.—It is reported that the Pacific Tel. & Teleg. Co. will expend about $80,000 in the construction of new telephone lines, installation of new switchboards and other improvements.

GRASS VALLEY, CAL.—The California-Montana Mining Co. is making arrangements for the installation of electric power in order to facilitate the development of its properties.

LOS ALTOS, CAL.—At an election held recently the proposition to form a lighting district was carried. The district will provide for from 50 to 100 street lamps and bids will soon be called for installation of the system and furnishing service.

LOS ANGELES, CAL.—According to reports, construction work is soon to be commenced on an electric railroad between Los Angeles and San Diego. It is understood that a syndicate headed by Franklin Helm, of Los Angeles, is back of the project.

LOS ANGELES, CAL.—F. L. Roehrig, 252 South Broadway, is reported to have been retained by the Aqueduct Advisory Board as consulting architect to supervise the preparation of the plans for the San Francisco Canyon power house No. 1, the cost of which is given as $100,000.

PATTON, CAL.—Robert Dalziel, Jr., of San Francisco, is reported to have submitted the lowest bid, $23,127, for the construction of a power plant at Patton for the Southern California State Hospital.

PERRIS, CAL.—Among the improvements planned by the Southern Sierras Pwr. Co., of San Bernardino, is the erection of a transmission line from Perris to Elsinore.

POMONA, CAL.—The Pomona Mfg. Co., manufacturer of pumps, expects to install an electric power plant in the new factory which it is constructing in Pomona.

RANDSBURG, CAL.—The Southern Sierras Pwr. Co., which has about finished the section of a 110,000-volt line between San Bernardino and Randsburg, contemplates the erection of a substation at the latter place which will furnish electrical energy to the mines and mills in that section.

REDLANDS, CAL.—Work will begin within 90 days by the Southern California Edison Co. on the construction of its high-tension transmission line from the Mill Creek power house through Yucapia Valley. About 10 or 12 miles of steel towers and pole lines will be erected.

REDLANDS, CAL.—The Arthur S. Bent Const. Co., Central Building, is reported to have secured the contract at $250,000 for the construction of a power plant and pipe lines in Mill Creek Canyon for C. G. Baldwin. The power plant will be of reinforced concrete construction and will have a capacity of 2000 hp. A steel-tower system will transmit electrical energy to different sections of the valley.

RIVERSIDE, CAL.—The City Council is reported to have approved the installation of 300 concrete ornamental street-lighting posts.

RIVERSIDE, CAL.—The Rogers Development Co. has closed a contract with the Southern Sierras Power Co. whereby the latter will supply the development company with electricity to operate the several pumping plants in connection with the irrigation of 5500 acres known as the Jurupa Ranch.

SAN LUIS OBISPO, CAL.—The franchise for furnishing electricity for lamps and motors in San Luis Obispo has been awarded to the Coalinga Wtr. & El. Co.

STOCKTON, CAL.—The Board of Supervisors has authorized an assessment of $72,000 in Reclamation District No. 348 to provide funds for building of levees and the installation of electric pumps.

TULARE, CAL.—It is reported that a special election is to be called in this city for the purpose of voting on an appropriation for a complete electric telegraph-alarm system.

LAMAR, COL.—The Lamar El. & Htg. Co. has decided to change its lighting system from direct current to alternating current.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until Aug. 15 for furnishing and delivering during the fiscal year ending June 30, 1913, street sign frames, underground signal and cable and cast-iron lamp-posts for use in the electrical department. Specifications may be obtained from the purchasing officer, District of Columbia.

TAMPA, FLA.—The Tampa El. Co. has purchased a tract of land directly opposite its present power station, and it is understood that important improvements will shortly be made in its system.

WINTER GARDEN, FLA.—The Winter Garden Lt. & Wtr. Co. is planning to build a combined electric and ice plant, to cost about $20,000.

DALTON, GA.—Negotiations are under way between the City Council and the Georgia Ry. & E. Co., Atlanta, whereby the company will be granted a charter to extend its transmission lines into Dalton.

SWAINSBORO, GA.—Arrangements have been made for the installation of a municipal electric-light plant, for which bonds to the amount of $7,500 were recently voted.

VALDOSTA, GA.—Arrangements have been completed by the Valdosta Ltg. Co. for taking over the property of the Consolidated Ice & Pwr. Co. It is the intention of the new owners to make many improvements in the plant.

WATKINSVILLE, GA.—The Legislature has passed a bill authorizing the town of Watkinsville to issue bonds for the purpose of installing a lighting system.

PRIEST LAKE, IDAHO.—It is reported that a hydroelectric power plant is to be installed by the Idaho Continental Mines.

CANTON, ILL.—The Canton Gas & El. Co. is extending its transmission lines to St. David and Norris to supply electrical service in those towns. It is also proposed to supply electricity for lamps and motors to several of the mines near here. The company is also negotiating for a contract to supply electricity in Cuba.

CHARLESTON, ILL.—It is the intention of the Central Illinois Tract. Co. to extend its lines from Charleston to Paris.

PEORIA, ILL.—The Peoria Gas & El. Co. has purchased a site in East Peoria on which it purposes to erect a power plant.

PEORIA, ILL.—An ordinance has been passed by the City Council compelling electric-light companies to place their wires underground for a distance of 2 miles on Washington Street.

PEORIA, ILL.—A petition has been presented to the City Council by the Schipper & Block Co. and other business firms requesting that an ornamental lighting system be installed the entire length of Fulton Street, the property owners to install the standards and globes and the city to supply the electrical energy.

QUINCY, ILL.—Property owners on Hampshire Street, between Sixth and Seventh Streets, have signed a petition for the installation of an ornamental lighting system.

ROCKFORD, ILL.—It is reported that an ornamental lighting system is soon to be installed on the business portion of East State Street from the bridge to Kishwaukee Street.

TUSCOLA, ILL.—The Central Illinois Public Service Co., which recently took over the property of the Tuscola Wtr. & Lt. Co., is planning to make extensive improvements in the plant. New engines and boilers are to be installed and transmission lines erected to neighboring cities.

CROWN POINT, IND.—The Calumet El. Co., recently incorporated, is soon to let a contract for the erection and equipment of an electric light and power plant. A. L. Courtright is president and T. A. Platt secretary.

LEBANON, IND.—The Middlewest Utility Co., Chicago, is reported to have purchased the property and holdings of the Citizens' El. Lt. & Pwr. Co. in Lebanon. The consideration is said to be in the neighborhood of $250,000.

NEW ALBANY, IND.—The Board of Public Works has under consideration an ordinance granting the Federal Sign System El. Co., Louisville, Ky., a franchise to establish a "White Way" in the business section of the city. The company asks for permission to erect standards and to install underground conduits for wires and to purchase or generate electricity for illumination purposes.

BENNETT, IA.—The contract for construction of a power house for the municipal electric-light plant has been awarded to Dr. F. A. Blakeslee, Bemidji, Minn. The cost of the plant is estimated at about $4,000. J. B. Vaughn is town clerk.

BROOKLYN, IA.—W. C. Walters and son, Toledo, representing Col. W. G. Dows, Isaac B. Smith, John A. Reed and R. S. Cook, Cedar Rapids, are making investigations here with a view of extending their system to Brooklyn, provided arrangements can be made with the Council for street lighting and for pumping the city water.

BURT, IA.—Plans are under consideration for extending the transmission lines of the municipal electric-light system to Burt.

CARLISLE, IA.—A special election will be held to vote on the proposition of installing an electric-lighting system.

CRESTON, IA.—Investigations are being made by the Creston Mutual El. Lt., Ht. & Pwr. Co. in Audubon with a view of extending its transmission lines to this place to furnish electrical service here.

DYERSVILLE, IA.—The City Council has authorized the committee

on fire, light and water to secure estimates on the cost of the installation of an ornamental street-lighting system using electroliers carrying five lamps each.

EARLVILLE, IA.—The Earlville El. Lt. Co. expects to install a new street-lighting system and electrical equipment for pumping water. The contract for the work is said to have been awarded to H. J. Jaeger, of Dyersville, Ia.

ELDORA, IA.—The City Council has decided to change the present arc-lamp street-lighting system to cluster lamps, using 42 electroliers and 100 incandescent lamps.

GOLDFIELD, IA.—The Citizens' Lt., Ht. & Pwr. Co., Eagle Grove, has applied to the Town Council for a franchise to supply electricity for lamps and motors. Electricity to operate the system will be supplied from the Eagle Grove plant.

GRINNELL, IA.—The Interior Tel. Co. is planning to rebuild its system at a cost of about $25,000.

HUXLEY, IA.—A franchise has been granted in this city to the Boone El. Lt. Co.

OGDEN, IA.—The Central Iowa Lt. & Pwr. Co., Fraser, has submitted a proposition to the City Council offering to extend its transmission line from Fraser to Ogden to supply electricity to operate the municipal electric plant and water-works pumping station.

RHODES, IA.—The installation of an electric-light system here is under consideration.

SHEFFIELD, IA.—Reports are current that citizens of Sheffield are organizing a new electric light and power company.

TOPEKA, KAN.—It is reported that the city commissioners have awarded to the L. E. Overton Electr. Eng. Co. the contract to install the East Fourth Avenue extension of the Great White Way, the price named being $5,973.

TOPEKA, KAN.—Plans are being considered by the Board of Water and Light Commissioners for rebuilding the municipal electric-light plant to furnish electricity for commercial purposes. The cost of the work is estimated at about $400,000. The city plant is now furnishing electricity for street lighting only.

ASHLAND, KY.—Preparations are being made by the Ashland Wtr. Pwr. Co. for extensions and improvements to its power plant.

EMINENCE, KY.—It is understood that the representatives of H. M. Byllesby & Co. are negotiating for the purchase of the Eminence El. Lt. Co.'s plant. Should the deal be consummated it is the intention of the new owners to furnish energy to New Castle and Pleasureville as well as to Eminence.

LOUISVILLE, KY.—The Louisville Ltg. Co. expects to extend its transmission lines to Jefferson, Ky., a 20-year contract to supply electrical energy in that city having been secured.

RICHMOND, KY.—It is reported that deals have been closed by the Dix River Pwr. Co. for the purchase of the electric-power plants at Richmond, Danville, Frankfort, Versailles and Lawrenceburg and that negotiations are under way for the purchase of plants in several other places in this section.

BATON ROUGE, LA.—Newspaper reports state that a $15,000,000 corporation for reclamation and drainage purposes and for the development of electrical power has been practically formed, plans having been submitted to the State Tax Commissioner at Baton Rouge by Welbourne Bradford, representing New York interests.

BALTIMORE, MD.—The Board of Estimates will call an election in November to vote on the proposition to appropriate $2,000,000 for extension of the electrical subway system.

BALTIMORE, MD.—The contract for supplying the city with electric light bulbs and electric lamps for the use of the various departments is reported awarded to the Baltimore El. Lt. Co. for $7,537.

BALTIMORE, MD.—The lighting department is planning to erect ornamental posts on North Charles Street, from North Avenue to the Boulevard, with lamps similar to those now on the boulevard.

SECURITY, MD.—The Hagerstown & Frederick Pwr. Co. has awarded the contract for construction of a new power house, to cost about $40,000, to Captain Hunter B. Crimm, of Winchester.

HAVERHILL, MASS.—The City Council is reported to be considering replacing the naphtha lamps now in use in the outlying districts with electric incandescent lamps. In order to replace the naphtha lamps an entire new system beginning at the power house and extending through the center of the city will have to be installed.

HOLYOKE, MASS.—The contract for installing a new conduit system for the municipal electric-light plant was awarded to P. J. Kennedy, Holyoke, whose bid was $39,186 for fiber conduit and $39,646 for vitrified conduit.

LAWRENCE, MASS.—Extensive improvements are contemplated by the Wamesit Pwr. Co. to its plant here, to cost about $25,000.

ORANGE, MASS.—The Massachusetts Northern Rys. Co. expects to begin work this fall on the construction of an electric railway from Orange to Millers Falls, for which all franchises have been secured.

PALMER, MASS.—The Central Massachusetts El. Co., of Palmer, is planning additional improvements in its plant at Blanchardville.

SPRINGFIELD, MASS.—The installation of a 1500-hp steam turbine with generators and engine is contemplated by the Strathmore Paper Co.

STONEHAM, MASS.—All wires of the telephone and electric-light systems are to be placed underground through the center of the town. The Bay State Street Ry. Co. has signified its willingness to replace the present wooden poles with iron poles as soon as the wires are placed underground.

CONSTANTINE, MICH.—Sealed bids for electrical street and commercial lighting in the village of Constantine for ten years from March 1, 1913, will be received by S. D. Hoffman, chairman of the lighting committee, Constantine, Mich., up to Aug. 27, 1912.

ALBERT LEA, MINN.—The City Council is considering an ordinance requiring all electric wires to be placed underground.

HILLS, MINN.—A movement has been started to secure the installation of an electric-light system here.

MADISON, MINN.—Bids will be received until Aug. 22 by James H. Hayden, city recorder, for furnishing material and constructing a water-works system and electric-light plant. E. D. Jackson, St. Paul, is engineer.

MINNEAPOLIS, MINN.—It is reported that the Minneapolis General El. Co. will expend several million dollars developing 160,000 hp of electricity. George H. Harries will be general manager.

ST. PAUL, MINN.—Griggs, Cooper & Co., St. Paul, have been granted a permit to erect a two-story brick power house, 100 ft. x 100 ft., to cost about $20,000.

WOLVERTON, MINN.—A special meeting is to be called by the City Council to vote upon a $3,500 bond issue, the proceeds of which are to be used for the installation of an up-to-date street-lighting system.

ST. LOUIS, MO.—Bids will be received until Aug. 13 by the Board of Public Improvement, St. Louis, William T. Bindley, secretary, for furnishing and installing at high-service station No. 3, Baden, a 250-kw direct-connected engine and generator unit; also a 100-kw motor-generator set.

STEWARTSVILLE, MO.—The City Council has granted a franchise to J. B. Reesaman, Mayville, Mo., to install and operate an electric-light plant.

RED LODGE, MONT.—A petition has been filed with the City Council requesting that an ornamental street-lighting system be installed throughout the business district.

CAMDEN, N. J.—The Keystone Leather Co., Camden, is planning to erect a new power plant, plans for which have been prepared by Charles J. Brooke.

CAMDEN, N. J.—The City Council is considering an ordinance requiring all telephone and telegraph wires to be placed in conduits as soon as they are installed. The city is to have the use of the conduits if it wishes it.

ELBERON, N. J.—The Deal Beach Ltg. Co., Deal Beach, contemplates extending its electric-light system to Elberon.

NEWARK, N. J.—The Board of Education, R. D. Argue secretary, will receive bids up to Aug. 22 for the electric work, lighting fixtures and vacuum-cleaning system required in the Newton School addition.

NEWARK, N. J.—The Board of Works has renewed its contract for street lighting with the Public Service El. Co. for a period of one year. The system comprises 2761 7½-amp inclosed arcs at an average rate of $66.90 per lamp. Heretofore the rate has been $70. The city plans for the installation of magnetic arcs at the termination of the contract, if the same meet requirements.

ADAMS, N. Y.—Permission has been granted by the Public Service Commission, Second District, to the Adams El. Lt. Co., Ltd., to sell its electric-light plant to the Adams El. Lt. Co., the latter being authorized to exercise the franchises granted in the towns of Adams and Watertown for the distribution of energy in these places. The latter company has also been authorized to issue $20,000 of bonds, $12,400 of which are to be used for the construction of transmission lines from Watertown to Adams and $7,600 for improvements and additions to the plant in Adams.

BINGHAMTON, N. Y.—It is understood that the Board of Education in this city is to install three new alternating-current motors in the High and Barlow Street schools and one in the school in St. John Avenue. This equipment is to replace direct-current motors now in use.

CHARLOTTE, N. Y.—At a special election recently held in Charlotte it was decided to contract with the Rochester Ry. & Lt. Co. for the purchase of electric light and power.

COOPERSTOWN, N. Y.—The Clinton Mills Pwr. Co. has contracted with the General El. Co. for the installation of an entire new electric-lighting system, to cost from $25,000 to $30,000. Electricity for operating the local system will be obtained from the plants of the Hartwick Pwr. Co. The contract calls for a 60-cycle system with arc or incandescent lamps for street lighting.

FREEPORT, N. Y.—The Public Service Commission, Second District, has granted a franchise to the Freeport R.R. Co. to construct an electric railroad in Freeport, Nassau County.

NEW YORK, N. Y.—Bids will be received until Aug. 19 at the office of William J. Gaynor, Mayor of New York City, for lighting fixtures for the new Twenty-second Regiment Armory, borough of Manhattan; security $9,000. Walker & Morris are the architects. Bids will be received at the same place for a flaming-arc system for the Second Battalion, Naval Militia Armory, borough of Brooklyn; security $1,500.

PALENVILLE, N. Y.—The Village Improvement Society has voted to

contract with the Catskill Illg. & Pwr. Co., Catskill, for lighting the streets of the village for a period of five years. The contract calls for 20 incandescent lamps of 30 cp.

ROCHESTER, N. Y.—A movement has been started by residents of the West Henrietta Road from 1½ miles to 2 miles outside the city limits for the installation of Mazda lamps along that thoroughfare.

LAURINBURG, N. C.—Proposals are being received by John F. McNair, Laurinburg, N. C., for electric dynamos for fertilizing plant.

MANDAN, N. D.—The Mandan El. Co. is planning to install a 300-kw generator in its plant.

NEW ROCKFORD, N. D.—An electric-lighting system is being installed in New Rockford by the W. T. McCaskey Co., a 23-year franchise having been secured by it.

COLUMBUS, OHIO.—Permission has been granted by the State Public Utilities Commission to the Columbus, Kenton & Toledo Trac. Co. to issue sufficient stock and bonds to enable it to complete its proposed line from Toledo to Columbus. The line will pass through Findlay, Kenton, Richwood and Delaware.

COLUMBUS, OHIO.—Advices have been received from Samuel H. Kinnear, director of public service, that the contract for constructing a substation for the municipal electric-light plant and water-works on East Chittenden Avenue, bids for which were opened July 29, has been awarded to Adam Pitts, 2327 High Street, for $7,476.

CRIDERSVILLE, OHIO.—The Sheets El. Co., Botkins, has applied to the Village Council for a franchise to install and operate an electric system here.

EAST LIVERPOOL, OHIO.—It is reported that the Tri-State Ry. & El. Co. expects to expend about $2,000,000 in the improvement of its plant. A new power house is to be erected at the Island Run coal mines, East End, the initial cost of which is placed at $1,500,000.

KENTON, OHIO.—The Hardin-Wyandot Ltg. Co. has completed its transmission lines from Kenton to Forest and is supplying electricity from the local plant in Forest. The power station in Forest has been closed down and the transmission line will soon be extended to Upper Sandusky and adjacent territory. Bids are being called by the company for the construction of a new power station in Kenton. Work will begin immediately on the erection of the building and installation of new equipment. Frank A. Potter, New York, N. Y., is president.

MOUNT VERNON, OHIO.—The property of the Mount Vernon El. Co. has been acquired by the American Gas & El. Co., New York, N. Y. The new owners will begin work immediately on improvements to the power plant. Transmission lines will be extended so as to provide current for commercial or domestic use, and new lines erected to the outskirts of the city.

OSNABURG, OHIO.—The project to issue $7,000 of bonds for the purpose of installing a municipal lighting plant was vetoed at a recent election held in this city.

RICHWOOD, OHIO.—The Richwood Lt., Ht. & Pwr. Co. has petitioned the Public Service Commission for authority to issue $6,825 in bonds, the proceeds to be used for extensions and improvements.

McLOUD, OKLA.—Steps have been taken toward the installation of a water-works system and electric-light plant in McLoud.

FREEWATER, ORE.—The Walla Walla Ry. Co. contemplates the construction of a new electric line from Freewater to Hudson Bay.

WINCHESTER, ORE.—The electric-power plant on the North Umpqua River at Winchester, owned by J. L. & S. A. Kendall, Roseburg, has been purchased by the Welch interests, of Portland. Extensive improvements and additions are contemplated by the new owners to both the water and light systems. The service is to be extended over considerable more territory. The erection of a transmission line to Sutherlin is under way.

PANAMA.—Proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Aug. 27 for furnishing steel oil tanks, steel channels, ingot copper, electric wire, indicator cocks, low service pumps, glass globes, etc. Blanks and general information pertaining to this circular (No. 723) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing agent.

ANNVILLE, PA.—The Edison El. Illg. Co. has closed a contract with the Annville & Palmyra El. Lt. Co., Tobias Bomberger, president and manager, to furnish electricity for operating the systems in Annville and Palmyra for a period of 10 years, beginning Oct. 1. The local station will be converted into a substation. It is expected that improvements will be made to the street-lighting systems in both towns.

BRADFORD, PA.—Press reports state that plans are being drawn by the Penn. R. R. Co. for the erection of a new $40,000 electric power house at Bradford. The purpose is to install a plant which will light the yards of the company and furnish electrical energy for the operation of its machinery.

BUTLER, PA.—Preparations are being made by the West Penn Trac. Co. for the erection of a high-tension transmission line from Freeport to Tarentum. As soon as the line is completed to the latter place work will begin on the construction of a high-tension line from Freeport to Butler. John H. Humphrey, Butler, is superintendent of the local plant.

NEW FREEDOM, PA.—At an election held recently the proposition to issue bonds increasing the indebtedness of the borough from $13,600 to $22,600, the proceeds to be used for enlarging the municipal electric-light plant, was carried.

PHILADELPHIA, PA.—It is understood that Philadelphia and Allentown capitalists are planning the construction of two 28-mile electric lines between Ithaca and Portland, N.Y. Elias Chandler, of Atlantic City, and Howard Chandler, of Philadelphia, are interested in the project.

TITUSVILLE, PA.—The Petroleum Tel. Co. has awarded contract for the installation of 4500 ft. of conduit in the business section to John Johnston. This is the beginning of the work of placing all wires underground. The Bell Tel. Co. has applied for permission to lay about 10,000 ft. of conduits.

WAYNE, PA.—The capital stock of the Merion & Radnor Gas & El. Co. has been increased from $1,000,000 to $5,500,000.

YORK, PA.—Steps have been taken to organize a new electric-power company by local business men for the purpose of supplying electricity to a number of townships in York County, including Manchester, East Manchester, West Manchester and Dover. Power for operating the proposed system will be obtained from the York Haven Wtr. & Pwr. Co. Harrison B. Waltman, Charles A. Greenawalt and James J. Gerry are interested.

NEWPORT, R. I.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 24 for construction of a power-plant building at the United States naval torpedo station, Newport, R. I., to cost about $30,000. William M. Smith is acting chief of bureau.

VERMILION, S. D.—It is reported that Theo. Anker, county auditor at Vermilion, will receive bids until Aug. 27 for electric-light fixtures for the court house. Lloyd D. Williams, Wead Building, Omaha, Neb., is the architect.

ATHENS, TENN.—Preparations are being made by the Tennessee Pwr. Co. for the erection of a transmission line from Athens to Etowah. The company is also contemplating building a line from Parksville via Cleveland to Nashville. Work will soon begin on the erection of both lines.

PRENDERGAST, TENN.—Plans are being prepared for the construction of a building, 200 ft. x 166 ft., to cost about $20,000, for the Prendergast Cotton Mills. The equipment will include 10,000 spindles to be electrically operated. The cost of the machinery is estimated at $80,000. W. J. McLenden is president.

CUMBY, TEX.—The city commissioners have granted a franchise for the installation of an electric-light plant here.

DALLAS, TEX.—It is reported that arrangements are being made for the installation of an electric-lighting system in the business district of Dallas, extending from Houston Street to Central Avenue. The cost of the proposed system is said to be approximately $56,000.

MOUNT PLEASANT, UTAH.—Bonds to the amount of $38,000 have been voted for the erection of a municipal electric plant. It is proposed to erect a plant at the mouth of Pleasant Creek. The City Council is negotiating with the Mount Pleasant Mill & Pwr. Co. for its electric plant and distributing system.

BURLINGTON, VT.—It is reported that the People's Gas & El. Co. has been granted a five-year contract to furnish arc lights for street lighting in Burlington.

BUENA VISTA, VA.—Newspaper reports state that the plant of the Buena Vista Light & Power Company has been completely destroyed by fire.

EAST RADFORD, VA.—Bids will be received until Aug. 19 at East Radford for a vacuum sweeping system for the administration building, State Normal and Industrial School, now under construction. For further information address Charles M. Robinson, Inc., Richmond, Va., architect. W. T. Baldwin is chairman building committee.

GALAX, VA.—The Appalachian Pwr. Co. has awarded a contract to the Tower-Binford Electrical Co. for electrical equipment for its system in Galax.

STAUNTON, VA.—The Board of Supervisors has granted the Staunton Ltg. Co. a right-of-way to erect a transmission line from Staunton to Waynesboro, a distance of 12 miles. The company has contracted with the Riverside Lt. & Pwr. Co. for additional energy and will also erect a substation in Fisherville to supply electricity there.

WINCHESTER, VA.—The Winchester & Washington Ry. & Lt. Co. is planning to erect a new substation, work on which will soon be started.

CENTRALIA, WASH.—The Washington-Oregon Corporation is planning to begin work immediately on the erection of a 40-mile transmission line from Kelso to Centralia and Chehalis. Electricity will be furnished to small towns along the route.

DAVENPORT, WASH.—The Washington Consol. Tel. & Teleg. Co. expects to construct a telephone line south from Davenport to Harrington, Sprague and Odessa, a distance of about 75 miles.

EDMONDS, WASH.—The Edmonds El. Lt. & Pwr. Co. has been granted a franchise to erect a transmission line along the Hall's Lake Road from Edmonds to the King County line.

OAKVILLE, WASH.—Application has been made to the Town Council

by A. Welland for a franchise to install and operate an electric-light plant in Oakville. Contracts have already been placed for machinery.

SEATTLE, WASH.—Bids are soon to be asked, it is reported, for a light and power plant at the proposed Green River hotel and sanitarium. Messrs. Kingsley and Eastman are said to be interested in the project.

GRAFTON, W. VA.—All bids received July 29 for construction and furnishing machinery for a municipal electric-light plant and waterworks system have been rejected and new bids will be received until Aug. 28. W. C. Hanaway is city clerk.

LESTER, W. VA.—Gage Y. Kelly, of the Lester Lt. & Pwr. Co., is in the market for electrical equipment, including 3 miles No. 6 bare copper wire, hard-drawn, other wire, insulators, cross-arms, transformers, brackets, bolts, braces, etc.

MOUNDSVILLE, W. VA.—It is reported that plans are being considered for furnishing electricity from the plant of the Wheeling Electrical Co. in Wheeling to operate the local system. If plans are carried out, the plant of the Moundsville Electrical Co. will be converted into a substation to distribute the current. J. H. Garden, superintendent of the Wheeling company, has submitted a proposition to the City Council offering to install a cluster-lamp system, provided a contract is awarded the company.

DENMARK, WIS.—The installation of an electric-light plant in Denmark is under consideration.

MARINETTE, WIS.—Contracts have been signed by business men for special illumination on Main Street.

VANCOUVER, B. C., CAN.—The Canadian Northern Railway expects to electrify its line from Port Mann to Vancouver.

FREDERICTON, N. B., CAN.—Plans are under way for developing 10,000 hp at Meductic Falls on the St. John River, about 40 miles above Fredericton. A company has been organized under the name of the St. John Hydroelectric Co. to operate the plant. Electricity generated at the plant will be distributed along the St. John Valley, particularly in Fredericton and St. John.

ST. JOHN, N. B., CAN.—The Canadian Pacific Ry. Co. has awarded contract for design and construction of a 1,000,000-ton grain elevator at West St. John to the John S. Metcalf Co., Ltd., Montreal, Que., and Chicago, Ill. The elevator will be electrically driven and an electric generating plant is included in the contract. The cost of the work is estimated at $500,000.

New Industrial Companies

THE AUTOMATIC MACHINE & TOOL COMPANY, of Chicago, Ill., has been granted a charter with a capital stock of $25,000 to manufacture novelties, tools and light machinery. The incorporators are: J. Gabel, E. Mikkelsen and E. Mueller.

THE AUTOMATIC REGISTER COMPANY, of East St. Louis, Mo., has been incorporated with a capital stock of $1,000,000. The company proposes to manufacture a device for automatically registering in the auditor's office of an electric-railway company the amount of fares placed in the receiving cash boxes on the cars, for which it has the sole right.

THE CORNWELL ELECTRIC COMPANY, of St. Louis, Mo., has been incorporated by Benjamin S. Cornwell, William H. Chresinger and W. Viley. The company is capitalized at $3,000 and proposes to do electrical construction work and deal in electrical supplies, etc.

THE ELECTRO-MECHANICAL WORKS COMPANY, of New York, N. Y., has been incorporated by M. Davidson, Brooklyn; S. Tarbee and P. Lauter, of New York, N. Y. The company is capitalized at $25,000 and proposes to manufacture electrical apparatus.

THE ELLIOTT MOTOR ENGINE COMPANY, of Boston, Mass., has been incorporated with a capital stock of $300,000 by Gilbert R. Elliott, Dorchester; Frank P. Harris, Waltham, and W. C. Cogswell, Barristers' Hall, Boston, Mass. The company proposes to manufacture engines.

THE FRANKS MANUFACTURING COMPANY, of Rock Island, Ill., has been incorporated by W. L. Franks, E. Peters, E. Franks and G. C. Wanger, of Rock Island, Ill. The company is capitalized at $30,000 and proposes to manufacture electrical fixtures and novelties.

THE JUST TUNGSTEN LAMP COMPANY, of Cleveland, Ohio, has been incorporated by R. B. Richardson, A. H. Otis, M. J. O'Donnell, A. G. Newcomb and M. L. Tennie. The company is capitalized at $10,000 and proposes to deal in electrical supplies.

THE PLUG CONNECTION ELECTRIC COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $25,000 to manufacture apparatus used in electric fixtures. The incorporators are: S. G. Nisschbon, R. C. Einstein and J. F. Grayer, New York, N. Y.

THE SAFETY BURGLAR ALARM LOCK COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $50,000 by J. J. Lipski, C. W. Shaeffer and S. E. Greenberg. The company proposes to manufacture burglar alarms.

THE SWEDISH-AMERICAN TELEPHONE MANUFACTURING COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $60,000 for the purpose of manufacturing electrical and mechanical apparatus. The incorporators are: D. L. Morrill, W. H. Johnson and G. Holz.

New Incorporations

PHOENIX, ARIZ.—The Inter-California Pwr. & El. Co. has been incorporated with a capital stock of $1,000,000 by Clifford McClellan, R. B. McClellan and N. C. Keym, all of 410 Mills Building, San Francisco, Cal. The company proposes to generate and distribute electricity for all purposes and to supply water for domestic and other purposes, etc.

BRINKLEY, ARK.—The Brinkley Wtr. & Lt. Co. has been incorporated with a capital stock of $50,000 by J. E. Thompson, W. W. Sharp, Elmo Chaney, J. W. Neff and J. S. Mitchell.

WILMINGTON, DEL.—The Canada Gas. Lt. & Traction Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,000,000. The incorporators are: Garrett S. B. Mettler and John A. Sheldon, both of Wilmington.

MATHERVILLE, ILL.—The Matherville Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 to supply electricity for lamps, heat and motors. The incorporators are: Paul Wagner, J. W. Walsh, John J. Ryan, H. C. Lightner and W. W. McCullough.

AUGUSTA, MAINE.—The Southwestern Pwr. & Lt. Co. has been incorporated with a capital stock of $18,500,000 for the purpose of generating and distributing electricity. E. M. Hussey, Augusta, is president and treasurer.

BOSTON, MASS.—The General Pwr. Co. has been granted a charter with a capital stock of $50,000. The incorporators are: John E. Hill, Joseph Lovejoy and Frank A. Peacock.

LESUEUR CENTER, MINN.—The Lesueur County El. Lt. & Pwr. Co. has been incorporated with a capital stock of $500,000 by Walter D. Hodson, W. T. McCaskey, S. F. Saeger, all of Lansing, Mich.

SEDALIA, MO.—The City Lt. & Trac. Co. has been incorporated with a capital stock of $1,500,000 by C. E. Murray, J. E. Harsh and R. A. McGregor. The company proposes to supply natural gas, artificial gas and electricity for lamps, heat and motors in Sedalia.

POTEAU, OKLA.—The LeFlore County Gas & El. Co. has been granted a charter with a capital stock of $250,000. The incorporators are: Grey Moore, J. T. Little and T. R. Lunsford, all of Poteau.

Trade Publications

ELECTRICAL INSTRUMENTS.—The Weston Electrical Instrument Company, Newark, N. J., has made its miniature precision direct-current instruments the subject of Bulletin No. 8. A page is devoted to each type of instrument illustrated full-size and followed by the dimensions. Samples of scales and price lists are also included.

PYROMETERS.—The Brown Instrument Company, of Philadelphia, has issued a 56-page catalog which is said to be the most complete catalogue on pyrometers ever issued. The list of some users of these instruments shows the diversity of industries in which Brown pyrometers are used. The catalog is well illustrated and printed and has a very dignified cover.

WHITE RIVER DEVELOPMENT.—The Stone & Webster Engineering Corporation, of Boston, Mass., has been distributing copies of an attractive souvenir book of the N. E. L. A. convention held at Seattle, Wash., in June. This book describes the hydroelectric development on the White River, in the Puget Sound district in the State of Washington. This handsome souvenir is attractively illustrated and was prized by all who received copies at the convention.

TURBO-ALTERNATORS.—The British Thomson-Houston Company, Ltd., Rugby, England, has issued "Descriptive List No. 354," covering Curtis turbo-alternators. It treats in an excellent manner the theory, construction and operation of turbines for high, low and mixed pressure, turbo-alternators, reducing turbines and small turbines. It is of interest to note that the sales of Curtis tubo-alternators to municipalities, the government, central stations and street-railway companies in the United Kingdom aggregate over 228,609 kw.

Business Notes

HATMAN & GODFREY have opened an office in the Midland Building, Kansas City, Mo., for consulting work, specializing in mechanical, electrical and illuminating engineering. The members of the firm are Messrs. J. G. Hatman, F. O. Godfrey and E. M. Ruede.

BURKE ELECTRIC COMPANY.—The employees of the Burke Electric Company, Erie, Pa., held their eighth annual outing on July 27 at Conneaut Lake, Pa. The outing was arranged by the employees, the time needed being given by the company. The attendance was nearly 500.

THE PYRENE MANUFACTURING COMPANY.—Messrs. Darwin R. James, Jr., and E. A. Clapp have been appointed president and secretary of the Pyrene Manufacturing Company, New York, succeeding Messrs. Peter L. Wilbur and Otto Kelsey, resigned. Mr. Henry J. Cochrane, vice-president of the Astor Trust Company, has been elected a director of the Pyrene Manufacturing Company.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 30, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,033,786. MAGNETO-BATTERY SWITCH; H. G. Cox, Detroit, Mich. App. filed March 16, 1911. Push-button switch for automobile ignition system.

1,033,796. ELECTRICAL SWITCH; M. D. Greengard, New York, N. Y. App. filed Sept. 16, 1910. Pull type for cluster lamps.

1,033,799. ELECTRIC HEATER; J. E. Harvey, Milton, Mass. App. filed March 9, 1912. Water heater with embedded resistance and switch.

1,033,813. ARC-LAMP CONSTRUCTION; A. A. Low, Horseshoe, N. Y. App filed March 16, 1908. Ball-bearing electrode guide.

1,033,816. HEATING APPARATUS; G. Machlet, Jr., Elizabeth, N. J. App. filed Nov. 23, 1908. Automatic regulator with indicating device for a gas and air furnace; 110 claims.

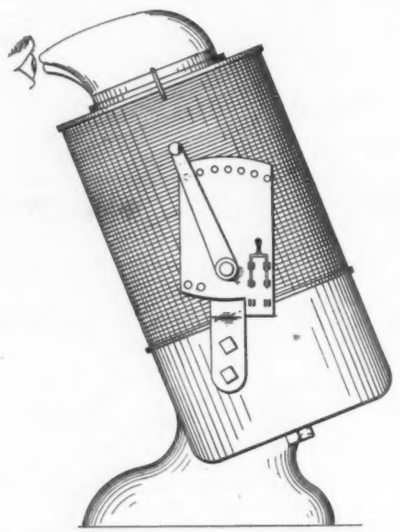
1,033,817. TELEPHONE WALL SET; R. H. Manson, Elyria, Ohio. App. filed Feb. 14, 1910. Interchangeable case for wall set, hotel set or desk set.

1,033,859. BANK OF KEYS; C. A. Bals, Chicago, Ill. App. filed, Aug. 2, 1909. Push-button switch for intercommunicating telephone system.

1,038,867. ELECTRIC HEATER; A. P. Blenkner and B. Z. Smith, Mountain Home, Idaho. App. filed Sept. 21, 1911. For a face steamer.

1,033,877. TELEPHONE EXCHANGE SYSTEM; E. R. Corwin, Chicago, Ill. App. filed Oct. 12, 1908. Multiple switchboard plug and jack.

1,033,883. ELECTROMAGNET FOR SURGICAL PURPOSES; G. T. Fette, Cincinnati, Ohio. App. filed Oct. 7, 1909. For extracting metal from the eye, etc.



1,033,883—Electromagnet for Surgical Purposes.

1,033,893. MERCURY MOTOR METER; J. H. Hodde, Springfield, Ill. App. filed Nov. 9, 1910. Anti-friction support for the rotating element.

1,033,900. MOTOR-CONTROLLING DEVICE; J. T. Janette, Chicago, Ill. App. filed Nov. 7, 1910. Automatic starting and stopping air-pump motors.

1,033,935. ELECTRIC SWITCH; G. B. Reisbach, Milwaukee, Wis. App. filed Dec. 26, 1908. Interconnection of two switches for controlling inductive circuits.

1,033,938. TELEPHONE-RECEIVER SHELL; F. C. Richey, Elyria, Ohio. App. filed Sept. 27, 1909. Metal shell with special joint for the cap.

1,033,982. MINIATURE SAFE; H. Beshore, Marion, Ind. App. filed Aug. 30, 1911. Sectional safe, particularly for use on the window-sill of a railway car.

1,033,989. RAILWAY SIGNAL; T. F. Coyd, North Yakima, Wash. App. filed Nov. 8, 1910. Electromagnetically controlled semaphore.

1,034,000. CIRCUIT CONTROLLER; W. H. Durfee, Providence, R. I. App. filed April 22, 1911. Multiple break with a plurality of movable-contact members on a carrier rod.

1,034,001. BELL-RINGING APPARATUS; W. H. Durfee, Providence, R. I. App. filed April 22, 1911. Keyboard operation of a musical instrument.

1,034,002. STORAGE BATTERY; T. A. Edison, Llewellyn Park, Orange, N. J. App. filed Jan. 27, 1911. Nickel hydroxide is mixed with freshly precipitated bismuth hydroxide and the mixture dried.

1,034,003. BATTERY-CELL CONTAINER; T. A. Edison, Llewellyn Park, Orange, N. J. App. filed Jan. 27, 1911. Frame for supporting a plurality of Edison storage-battery elements.

1,034,016. UNDERGROUND-TROLLEY SYSTEM; A. Kautzky, Los Angeles, Cal. App. filed May 15, 1911. Conduit with drainage.

1,034,018. MANUFACTURE OF TUNGSTEN FILAMENTS FOR INCANDESCENT ELECTRIC LAMPS; A. Lederer, Vienna, Austria-Hungary. App. filed June 8, 1909. Powdered metallic tungsten is mixed with the tungsten dioxide and binder.

1,034,069. ELECTRIC MOTOR; E. W. Brown, Dayton, Ohio. App. filed Dec. 1, 1911. Laminated squirrel-cage armature with special winding to avoid "humming."

1,034,108. DEVICE FOR CHARGING STORAGE BATTERIES; E. A. Halbleib, Rochester, N. Y. App. filed May 9, 1910. "Gassing" is employed for regulating the charging.

1,034,119. ELECTRIC-CIRCUIT-CONTROLLING SYSTEM; H. B. Kahn, New York, N. Y. App. filed Feb. 19, 1909. Motor-driven spring-moved snap switch with distant control.

1,034,129. SADIRON; C. P. Madsen, Salt Lake City, Utah. App. filed Jan. 22, 1908. A self-contained heater unit is interposed between a thin ironing plate and the heavy upper handle portion.

1,034,130. ELECTRIC HEATER; C. P. Madsen, Chicago, Ill. App. filed Sept. 23, 1908. A separate heating element suitable for various uses, such as sadirons, ovens, toasters, etc.

1,034,148. ATTACHMENT FOR TELEPHONES; W. A. Schmelz, Pittsburgh, Pa. App. filed Nov. 16, 1911. A flexible tube and earpiece attachment for a receiver.

1,034,151. COMBINATION LOCK FOR ELECTRIC LAMP FIXTURES AND THE LIKE; G. I. Silbert, Chicago, Ill. App. filed Sept. 12, 1911. To prevent the unscrewing of a lamp or plug.

1,034,156. STORAGE BATTERY; E. Sokal, Chicago, Ill. App. filed July 2, 1909. Forced circulation of the electrolyte with filtering medium. (See Patent No. 852,464.)

1,034,157. STORAGE BATTERY; E. Sokal, Chicago, Ill. App. filed July 2, 1909. Hollow electrodes. (See Patent No. 1,034,156.)

1,034,159. CONDUCTOR COUPLING; W. Sparks, Jackson, Mich. App. filed April 4, 1912. Small plug coupling for electric "horn."

1,034,160. ELECTRIC PRIMER; H. W. Starkweather, New Haven, Conn. App. filed April 22, 1912. A one-piece shell with a powder chamber and a container chamber.

1,034,167. SYSTEM FOR ELECTRICALLY CONTROLLING AND OPERATING RAILWAY-TRAFFIC-CONTROLLING APPARATUS; H. B. Taylor, Albany, N. Y. App. filed Aug. 12, 1910. For switches, derails, cross-overs and signals.

1,034,197. MEANS FOR THE PROTECTION OF ELECTRICAL INSTALLATIONS FROM EXCESS VOLTAGES; G. Campos, Milan, Italy. App. filed Aug. 12, 1910. Ohmic resistances in parallel with conducting means in series.

1,034,198. MEANS FOR THE PROTECTION OF ELECTRICAL INSTALLATIONS FROM EXCESS VOLTAGES; G. Campos, Milan, Italy. App. filed Aug. 19, 1910. Capacity and resistance appliances in shunt with the line wires.

1,034,200 TELEPHONE RECEIVER; L. W. Carroll, Riverside, Ill. App. filed Oct. 24, 1910. An actuating magnet on each side of the diaphragm.

1,034,219. ELECTROPLATING APPARATUS; J. W. Dow, Mansfield, Ohio. App. filed April 16, 1912. A tank with an endless conveyor with pockets for handling small articles.

1,034,223. ELECTRICAL ALARM; T. Erickson, Ogden, Utah. App. filed June 8, 1911. Operated by a depressible floor section.

1,034,241. TROLLEY; M. Jakubowski, Windber, Pa. App. filed Oct. 25, 1911. Spring-connected guards to prevent displacement.

1,034,261. AUDIBLE SIGNAL OR ANNUNCIATOR FOR INCUBATORS; H. R. Lightcap, Greensburg, Pa. App. filed Oct. 11, 1911. Thermally operated.

1,034,265. ELECTRIC HEATING DEVICE; C. P. Madsen, Chicago, Ill. App. filed Jan. 22, 1908. A pre-formed coil of wire-insulating material and binding cement.

1,034,276. COVERING FOR WIRE; C. Moon, McDonald, W. Va. App. filed Jan. 13, 1912. For protecting a trolley wire in mines, etc.

1,034,290. METHOD OF ELECTRIC WELDING; H. F. Parish, New York, N. Y. App. filed Aug. 11, 1911. A light, fusible metal wire forms a negative electrode.

1,034,292. OVERHEAD TROLLEY; R. A. Peglar, Toronto, Canada. App. filed Aug. 16, 1911. Spring-supported trolley pole with replacing device.

1,034,294. ARC LAMP; C. Gonzalez-Perez, Madrid, Spain. App. filed June 15, 1911. Each electrode is formed by two converging spring-pressed carbons.

1,034,380. THERMOMETER HOLDER; W. S. Atchison, Washington, D. C. App. filed May 4, 1912. A protecting device forming an electric contact.

1,034,393. ELECTRIC HEATER; R. M. Millar, Chicago, Ill. App. filed Jan. 9, 1911. Upright toaster.

1,034,394. INSULATING SUPPORT FOR STORAGE-BATTERY TANKS; G. H. Morris, Glencoe, Ill. App. filed Nov. 7, 1910. Has a fluid-containing chamber with a dust cap.

1,034,397. ELECTROMAGNETIC DEVICE; B. Soldatencow, Paris, France. App. filed Feb. 5, 1912. Solenoid with variable action.